Identification of Export Opportunities for Syrian Citrus Growers to the EU: A Supply Chain Perspective

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For my parents

Samir and Ibtessam

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List of Abbreviations

ACB	Agricultural Cooperative Bank
AAGR %	Average Annual Growth Rates
ASA	Annual Statistical Abstract
AASA	Annual Agricultural Statistical Abstract
ACR	Annual Change Rate
AEU	Agricultural Extension Units
AT	Action Threshold
BCG	Boston Consulting Group
BMPs	Best Management Practices
CAP	Common Agricultural Policy
CBD	Citrus Board Directorate in Syria
CBI	Centre for the Promotion of Imports from developing countries
CBS	Central Bureau of Statistics
CMO	Common Market Organization
CTZ	Citrus Tristeza Virus
CV	Coefficient of Variation
DAE	Department of Agricultural Economics
DF	Domestic Factors
EIL	Economic Injury Level
ET	Economic Threshold
EU	European Union
FAO	Food and Agricultural Organization
FAOSTAT	FAO Statistical data base
FCOJ	Frozen Concentrated Orange Juice
ft	Foot (plural: Feet)
GAFTA	Greater Arab Free Trade Area
GEFV	General Establishment of Fruits and Vegetable
GCSAR	General Commission for Scientific Agricultural Research

GDP	Gross Domestic Product
GEP	General Equilibrium Position
GESMAAP	General Establishment of Storing and Marketing of Agricultural and Animal Products
HDP	High Density Planting
IB	Industrial Bank
IICA	Inter-American Institute for Cooperation in Agriculture
IMF	International Monetary Fund
IPM	Integrated Pest Management
M. T.	Metric Ton = 1000 KG
NAO	National Agricultural Output
NAPC	National Agricultural Policy Center
N-QL	Non-Qualified Labor
NFCs	Not-From-Concentrates
N-TI	Non-Tradable Input
OECD	Organization for Economic Co-operation and Development
PAM.	Policy Analysis Matrix
QL	Qualified Labor
RCA	Revealed Comparative Advantage
RRA	Rapid Rural Appraisal
SAC	Supreme Agricultural Council
SANA	Syrian Arab News Agency
SCB	Syrian Central Bank
SEAA	Syrian-EU Association Agreement
SMAAR	Syrian Ministry of Agriculture and Agrarian Reform
SMI	Syrian Ministry of Industry
SP	Syrian Pound
SMF	Syrian Ministry of Finance
STB	Standardized Trade Balance
TI	Tradable input

TSS	Total Soluble Solids
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
USDA	United States Department of Agriculture
WTO	World Trade Organisation

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1. Introduction

1.1 Background

There are many factors contribute to shape Syrian agriculture. Despite problems and various difficulties that have characterized Syrian farming in the past decades, agriculture is still one of the predominant sectors in the economy and one which the country has to count on in the future for its social and economic development. These conditioning determinants may include the natural environment (particularly the water resources), the social and economic conditions of rural areas, and the wide spectrum of public policies affecting the Syrian agricultural sector.

Syrian Arab Republic lies on the eastern coast of the Mediterranean Sea, between the 32° and the 37° latitude North and between the 36° and 42° longitude East, in the Southwest part of the Asian continent (Figure 1). It ranges from the Mediterranean coastal areas to the West, to the desert area bordering Iraq and Jordan to the South and South-East, including highly diversified territories in terms of temperature, rainfall, soil characteristics and water resources.

From agricultural point of view, Syria has been traditionally divided up in five major agro-climatic zones[1] often referred to as settlement zones (Wattenbach, 2006); since Syria is characterized by Mediterranean climate of rainy winters and hot summers separated by two short transitional seasons (autumn and spring) and because of its diversity and of the importance that agro-climatic conditions have on agriculture and other human activities.

Syria is divided into 14 governorates from an administrative point of view. These governorates are distributed into four regions (Figure 1):

1. The northeastern region, including: Al-Hassakah, AL-Raqqa, Dair-ezzor, Idleb, and Aleppo.
2. The coastal region, comprising: Lattakia and Tartous.
3. The middle region, incorporating: Homs and Hama.
4. The southern region, consisting of: Damascus, Rif-Damascus, Dar’a, Sweida and Quneitra.

[1] See appendix 1 which presents the agro-climatic zones in Syria.

Figure 1: Map of Syria includes boundaries, vegetation and main cities

***Source**: Elaborated from URL: http://www.fanack.com/countries/syria/economy/agriculture.html*

Syria is generally characterized by limited rainfalls, which are further and heavily affecting both agricultural activities and agricultural production. The rainy season is generally between October and April, and reaches its peak between December and February. Seasonal and geographical distribution of rainfall is very important for agricultural production and forms the basis of the division of country into different agricultural zones. Thunderstorms accompanied by heavy showers do occur during winter with the intensity of such showers reaching 97 mm. within 24 hours in some regions.

The total land area of Syria is 18,518,000 hectares of which approximately 32% are arable. 69.6% of the actual cultivated lands are rain-fed and about 1,439,000 hectares are irrigated

(CBS, 2005). The area that is cultivated fluctuates each year according to rainfall. The pattern of seasonal rainfall is highly variable from year to year, which affects the yields, particularly of rain-fed crops (AASA, 2008). Rainfall during the period 2000-2006 was characterized by acceptable rates in all stabilization zones; the maximum precipitation was in season 2002-2003 in Safita[2] (Table 1). In season 2007-2008, rainfall was less than annual average in many rain stations especially in the Dier-Ezzor Province station (Table 1). The repeated drought and a declining rate of rain fall through the past years in Syria affected both the agricultural production especially the rain fed crops and the groundwater table for the irrigated ones.

Table 1: Rainfall in Syria according to rain stations during 2001-2009; (Rainfall: mm/season)

	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	Average
Sweida	283.3	338.4	522.2	235.8	317	267	286.5	189	306	305
Dar'a	165.2	218.1	453.3	216	230	221	195.8	218.5	275	243.7
Queneitra*	-	-	-	-	-	553.9	624.5	484.5	590.5	563.4
Damascus	154.9	183.6	171.9	214.5	173.6	172.4	201	202.7	178.4	183.7
Homs	388.9	406.2	794.2	480.8	437.2	404	334.1	449.4	495.6	465.6
Hama	375.2	305	570.6	379.5	316.5	304.5	341.8	284.7	308	354
Idleb	603.9	547.4	612.4	634.5	444.3	423.1	375.5	496	498	515
Tartous	641	1147	1325	872.6	739.9	1027.3	652.7	880	848.4	903.8
Safita	919.8	1260	1792.2	1243.8	981.7	1259.7	1089.9	1337	1139.7	1224.9
Banias	563.3	1249	1186	986	758	823	527	854	814.2	862.3
Lattakia	435.7	956.7	872.6	738.3	613.4	625.7	623.5	707.6	719.7	699.2
Hiffeh	684.5	1212.4	998.7	1080	909.5	800.7	666.7	1014	955	924.6
Aleppo	467	429.5	502.4	428	373	439	433	508	377.4	439.7
Al-Raqqa	229	177.3	192.3	215.8	123	168	129.5	74.5	105.8	157.2
Dier-Ezzor	239.7	144.7	135.7	157	158.6	168	162.7	56.3	90.3	145.9
Al-Hassakah	327.2	178.7	296.2	243.7	242.1	215.8	235.5	121.7	142.3	222.6
Al-Qamishli	494.2	334.1	467.1	427.5	310.8	360	374.4	221.2	265.8	361.7

*Quneitra stations were added from season (2005-2006)

Source: Elaborated from (AASA, 2009)

Based on above, the government has started a project of artificial rain to avoid the drought phenomenon, so there has been an increase in the rainfall rate from 6 to 16%. Like the

[2] **Safita** is a city in northwestern Syria, located to the southeast of Tartous city about 35 Kilometer, It is situated atop three hills and the valleys between them, in the Syrian Coastal Mountain Range about 380 meter above the sea level in the first Agro Ecological Zone.

drought, the over-rain also affects agricultural production and its efficiency because the floods would cause soil erosion and form water spots. That's why the government builds many dams (SMAAR, 2010).

Temperature fluctuating does widely affect the performance of the agricultural sector comprising both crop and animal production. A good part of the country is subject to large differences between night and daytime temperatures. Such differences in summer may reach 23 degrees in the interior region and 13 degrees in the coastal one. Temperatures can reach more than 45 degrees in summer and fall short below zero degree in winter (CBS, 2005).

With the exception of the coastal areas the relative humidity is generally high during winter and low in the summer. During summer, the average relative humidity ranges from 20-50% in the interior of the country and 70-80% in the coastal strip, while during winter it ranges from 60-80% in the interior and 60-70% in the coastal areas (CBS, 2003).

The majority of the inhabitants of Syrian Arab Republic are Arab, with small proportion of Armenian, Kurdish, and Gzerkesian origins. Most of the population is Moslem, small minority is Christian, and a few thousands are Jewish. At 01.01.2010, the population actually living in Syria was estimated at about 20.4 million, distributed as following:

1. 51.1% males and 48.9% females.
2. 53.5% urban and 46.5% rural.
3. Youth share[3] was 62% of the Syrian population.

During 2000-2008, the annual growth rate of population amounted to 3.7%. However, the annual growth rate of the rural population was 1.8% and the annual growth rate of the urban population was 5.5%. Over the same period, rural population increased by a lower rate than that of the total population and the urban population grew faster than the total population.

This high population growth induces a huge pressure on the Syrian economy and its natural resources. Since the population is evenly distributed between rural and urban, half of the population relies on agriculture and its related activities. The annual growth rate of the total number of agricultural employees was (-11.2%) for the same period (CBS, 2010). This significant decline in the number of agricultural employees was a result of:

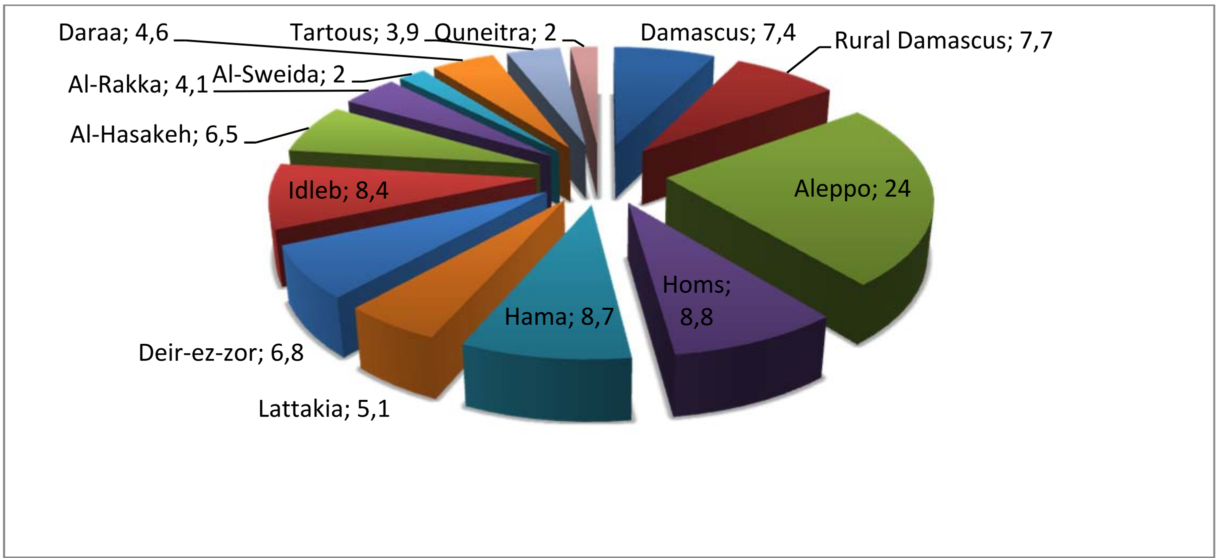
1. The drought that prevailed the country in the last years.

[3] It includes individuals who are younger than 24 years.

2. The introduction of modern technologies in agriculture.
3. The immigration from rural areas to the cities.

These circumstances influenced agricultural labor and productivity negatively, and led to decline in per capita of agricultural GDP share from 15625.2 million Syrian Pounds[4] in 2006 to 11956.4 million Syrian Pounds in 2008; thus, the compound annual growth rate for this period was -0.4% (CBS, 2010).

Figure 2: Percentage distribution of the Syrian population by governorates in 01.01.2010



Source: Own figure based on (CBS, 2010).

Figure 2 shows the percentage distribution of the Syrian population by governorates on 01.01.2010. It is obvious that the concentration of population was high in the provinces of Aleppo and Damascus with Rural Damascus because of the diversity of income sources.

This chapter will be dedicated to the presentation of the role that marketing process can play in organizing the supply chains and the possible implications of these activities for production and market equilibrium.

1.2 Problem statement

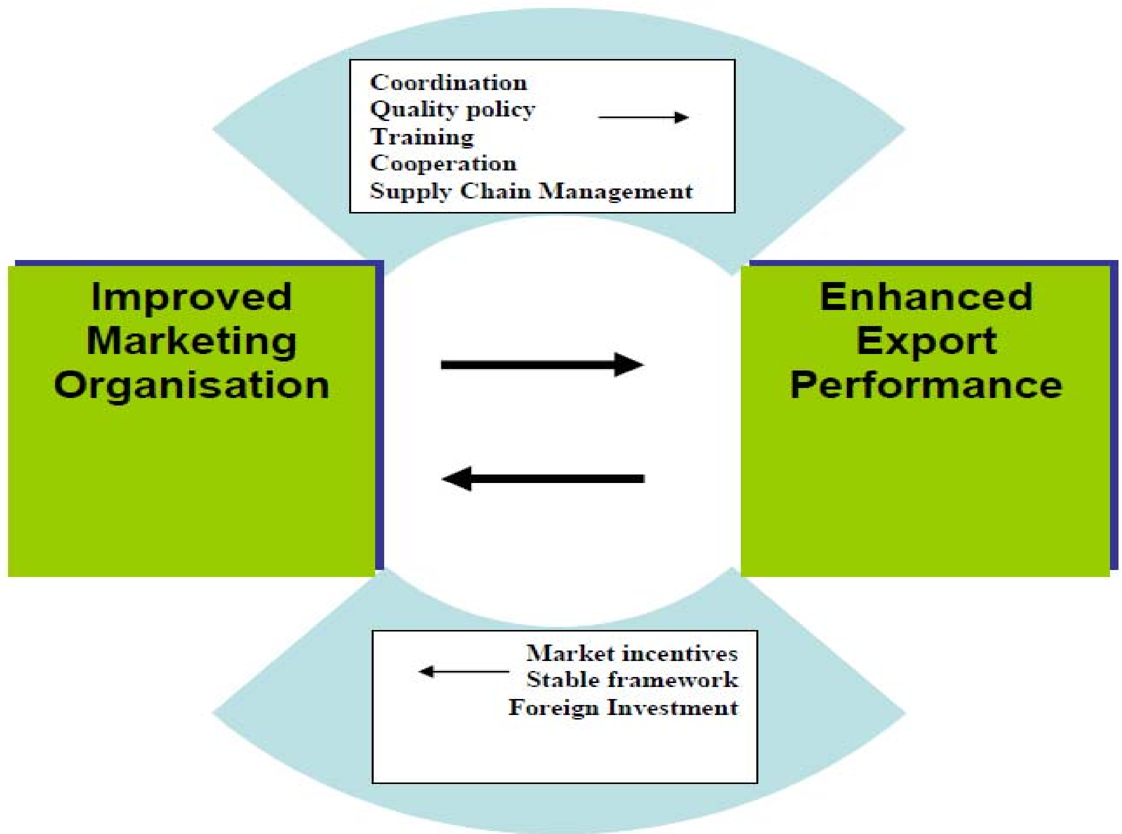
Alvarez-Coque *et al.* (2003) showed that the problem of export promotion for Syrian marketing fruits and vegetables is that the relation between domestic actors and foreign traders and even the retailers is guided by traditional rules, which involve high marketing costs. This traditional value chain was and still highly based, in some parts of the system, on

[4] The Syrian Pound exchange rate in December 2008 was US$ 1 = 46.5 Syrian Pounds (SP). For more information about exchange rates of foreign currencies, see appendix 2.

commissioners. This type of chains makes a relatively long and sophisticated distance between farmers and foreign markets, as well as it affects the capacities of exporting Syrian products to other countries. The aforementioned study referred also to one of the structural changes in the world markets induced by globalization. It is the supermarket revolution for retailers, and its differences from traditional marketing. As a paradigm shift in the way firms sought to compete started in the 1990s, whereas the nature of competition moves from firm against firm to supply chain against supply chain. This revolution is already happened in the EU, and it is newly taken place in the Arabic Gulf states were the retailing is increasingly concentrating[5].

The next figure illustrates the need for a comprehensive approach in order to overcome restricts of developing a successful fruit and vegetable exporting activity in Syria.

Comprehensive approach to enhance export activities in Syria



Source: Elaborated from (Alvarez-Coque *et al*., 2003).

[5] Currently, there are several giant retailers firms in the world. They have lot of information about markets and consumers more than any government and increasingly have more power on the global trade. Carrefour which is one of these retailer companies for agro food set a partnership in Syria.

As shown in the above figure the improved marketing organization is formed a precondition for enhancing export performance and vice versa. Favorable market signals and export results would be needed to create the right incentives for improving the efficiency of the marketing organization in Syria. Actions to be taken would go in two ways. Improving the marketing organization would include a number of actions consisting of actors' coordination, quality promotion, training activities, and supply chain management.

In 2005, Citrus Board[6] Directorate (CBD) in Syria reported that citrus fruits are one of the most promising products of fruits commodities. The most important advantages of Syrian citrus fruit are (CBD, 2005):

1. It is free of the impact of residual pesticides, because of applying the integrated biological control programs.
2. There are multiple varieties and strains (some items are from European countries) which have the advantage of medium-late and early maturity, about a month almost. These varieties and strains distributed throughout the year.
3. Syria produces about 100,000 tons of citrus fruit; most of them are known global varieties.
4. Syrian citrus fruit production is cheaper than prices in EU countries, at least at the farm level.

NAPC (2009) mentioned in the report of Syrian agricultural trade that there are a series of conditions which contribute to make fruit exports possible, such as availability and variety of product, extended harvesting seasons and farm price advantages. Despite the enjoyment of the Syrian citrus production to these terms and conditions, but the citrus exporting in Syria has not been considered an activity essentially different from domestic marketing. The appearance of citrus domestic surplus in Syria, which may often be seen as a sign of overproduction, normally finds its exit through the foreign marketing to neighboring countries in Arab region. While the natural resource base could represent an interesting framework for building export oriented businesses in Syria, current marketing organization appears fragmented and with evident inefficiencies.

The wholesale markets play a role in bridging the marketing gaps, but instead of facilitating the backward information flows along the marketing chain from consumers to growers, they are hardly efficient for cost control and quality monitoring. While the total number of traders

[6] CBD is a part of technical specialized offices Directorate in the Ministry of Agriculture and Agrarian Reform. It is located in Tartous City and it is responsible for citrus fruits affairs.

in the country is significant, the number of export-oriented traders is relatively small and when they exist, they do not offer regular volumes in the large amounts required by the modern distribution. In addition, they frequently fail to be in full control of the product quality from the field. Furthermore, problems linked to logistics and transport costs amplify market disorganization. Market transparency could improve by creating mechanisms for price information, promotion of quality standards and better co-ordination between actors.

Accordingly, it is very important to analysis the supply chain of citrus fruits, as it constitutes an important actor for improving the marketing organization in order to enhance their exports to the EU.

1.3 Hypotheses

Four hypotheses have been stated for this research:

1. There is surplus in production of citrus fruits in Syria.
2. Syria has a comparative advantage in producing citrus fruits.
3. Syria has an inefficient marketing system in comparison to the EU.
4. Supply chain of citrus fruits in Syria is hampered by the limited infrastructure.

1.4 Objectives

1. Studying the current status quo Syrian citrus fruits production.
2. Studying the current status of supply chain for citrus fruits in Syria.
3. Studying the current status of supply chain in the EU.
4. Managerial, administrative and governmental implications.

1.5 Methodology

1. Analysis of citrus fruits supply chain in Syria in order to collect relevant attributes of availability of supplies and competitiveness.
2. Analysis of demand statistics from EU institutions to have a clear view of EU production, import, export and consumption.
3. Analysis of the comparative advantage of citrus fruits production in Syria.
4. Questionnaire-based survey to explore the perception of wholesalers and retailers in the German market of fruit and vegetable and their expectation from Syrian citrus fruits.

5. Use of statistical data from Syrian government, EU institutions, FAO and other data resources like interviews with experts, farmers, traders, importers and exporters in Syria by using the Rapid Rural Appraisal (RRA).
6. Analyzing collected statistical data and surveys by using SPSS and Excel programs.

1.6 Required Data

In order to adjust the statistical data provided by different sources (FOASTAT for production and EUROSTAT for import and export) the import and export citrus fruits data presented in this study refer to aggregate of the following CN codes[7]:

1. Citrus fruits: 0805
2. Oranges: 080510
3. Mandarins, clementine, tangerines etc.: 080520
4. Lemons and limes: 080530
5. Grapefruits including pomelos: 080540
6. Citrus fruit, nes[8]: 080590

Primary Data: Semi-standardized Interviews with experts, farmers, traders, importers and exporters in Syria

Secondary Data: Data concerning production, consumption, exports, imports and prices in Syria, EU, and other statistical data.

These secondary data will be retrieved from the Ministry of Agriculture and Agrarian Reform in Syria, FAO, EU Institutions, and other institutions in Syria and EU.

Documentation and published references on this matter are scarce in Syria. Besides the sources indicated in the references section, non-published documentation has also been used. This was collected through non-structured interviews with about 30 people, from managers and executives in the public or private sector to scientists, traders and farmers. Moreover, interviews have been conducted with all the state agricultural companies and the joint-sector (public-private joint ventures) companies affiliated with the Ministry of Agriculture and Agrarian Reform (SMAAR), all the state food companies affiliated with the General

[7] Classification of ProdSTAT commodities: URL: http://faostat.fao.org/site/384/default.aspx.

[8] Citrus fruit, nes: Including inter alia: bergamot (Citrus bergamia); citron (C. medica var. cedrata); chinotto (C. myrtifolia); kumquat (Fortunella japonica). Some minor varieties of citrus are used primarily in the preparation of perfumes and soft drinks.

Organization for Food Industries (GOFI), the Ministry of Industry, and some relevant state companies affiliated with the Ministry of Economy and Foreign Trade (MEFT), and with the Ministry of Supply and Internal Trade (MSIT).

1.7 Organization of the Study

This study is divided into eight chapters. Chapter one reviews location and conditions in Syria, sets out the problem, states the study objectives, declares the hypothesis to be tasted, and introduces the general organization of the study.

Chapter two outlines social and economic structure of agriculture in Syria and gives general information about agriculture in Syria in the first two sections. Third Section describes the production and productivity of citrus fruits in Syria. Fourth section explains the attributes which affect the citrus fruits quality. The fifth one presents the concept of Integrated Pest Management programs and the sixth one show the production inputs for citrus fruits in Syria.

Chapter three give the economic perspective for citrus fruits production in Syria with respect to comparative advantage and competitiveness. Chapter four analysis the current status of supply chain (wholesale market, retailers, import and export) for citrus fruit in Syria.

Chapter five describes the current status of citrus fruit sector in the EU from export, import, and consumption sides. Chapter six includes and empirical analysis for the citrus fruit supply chain in Germany.

Chapter seven summarizes the conclusions and constrains of the study, while the last chapter gives managerial, political, administrative and governmental implications.

2. Syrian citrus fruit production

2.1 The economic importance of agriculture in Syria

Between the periods 1999-2001 and 2006-2008, the average annual Syrian economic growth rate[9] was 4.9%. The GDP grew by about 5.7% in 2007 over the previous year and by 4.3% in the next year. The per capita GDP in 2006 amounted to 64,919 Syrian Pound (SP), (about US$ 1298)[10], this share increased over the next two years and amounted 68,178 SP (about US$ 1463).

Table 2: Structure of Gross Domestic Product at market prices by Sectors, 1990-2009 (at constant 2000 prices in %)

Sector	1980	1990	1995	2000	2005	2006	2007	2008	2009 [1]
Agriculture	29	25	23	25	23	24	20	18	19
Mining & Manufacturing	15	26	28	30	25	24	23	23	23
Building & Construction	7	3	3	3	4	4	4	4	4
Wholesale & Retail Trade	23	20	21	15	20	18	20	22	21
Transport& Communications	7	10	11	13	11	11	12	12	12
Finance & Insurance	5	3	4	4	4	5	5	5	5
Social & Personal Services	3	2	2	2	3	3	3	4	4
Government Services	11	11	8	8	10	11	13	12	12
Private Non-Profit Services		0	0	0	0	0	0	0	0
Customs Duties					2	2	2	2	2
(-) FISIM [2]					2	2	2	2	2
Total	100	100	100	100	100	100	100	100	100

[1] Primary data

[2] Value of financial intermediation services

Source: Elaborated from CBS, the ASA 1980, 1985, 1990, 1995, 2000, 2005 and 2010.

[9] It is represented in GDP at market prices in the terms of 2000 constant prices.

[10] See appendix 2.

With respect to the economy and despite recent developments in the trade sector, the Syrian economy remains considerably dependent on the agricultural sector which constituted about 23% of Gross Domestic Product in the year 2005. Other sectors, which make significant contributions to the national economy, are mining/manufacturing and trade (Table 2).

The share of agriculture of total GDP remained relatively stable during 1990-2006 around 24%, but showed a longer term decline after reaching 29% in 1980. This contraction is not the result of a decline in agricultural value added; rather it is the consequence of the faster growth of other sectors. In particular, the growth of the mining sector's share is due to the increase of the world oil prices. Table 2 shows another decline in the contribution of agriculture to the total GDP between 2006 and 2009, it was 18% in 2008 and 19% in 2009, due to drought that struck the agricultural areas in Syria, and partly, because of the liberalization of the Syrian market from the restrictions. These two reasons affected the Syrian agricultural sector, the farmers, and producers, negatively.

Recently, the importance of agricultural trade increased as a result of pursuing the policy of economic openness toward global markets by the Syrian government. Agricultural trade formed about 77% of agricultural GDP in the period between 2006 and 2008. It has evolved very rapidly between 2006 and 2008 where the growth rate increased by 31.5% in 2007 compared to 2006. Up to 2009 the growth rate of agricultural trade increased by 71.4% (SMF, 2009; CBS, 2009).

In 2009 the value of agricultural production was 778 billion SP[11] at current prices and 394 billion SP at constant prices of 2000 while it was 337 billion SP in 2000 (CBS, 2010)

2.2 The economic importance of Syrian citrus fruits

Table 3 shows that the contribution of fruits in the total value of agricultural production was unsteady compared with plant production value as a result of climate problems and the strong biennial yield pattern, especially in apples and citrus fruit trees[12]. However, this contribution was approximately stable with respect to the plant production value (CBS, 2005; CBS, 2010).

In 2009, Syria occupied the third place in the Arab world in the production of citrus fruits, after Egypt and Morocco, and the twentieth rank in the world. The total produced quantity

[11] The exchange rates for different foreign currencies are presented in appendix 2.

[12] These two fruit types form the essential production of fruit trees in Syria, about 73% of total fruit trees production.

was about 1.1 million tons; it reached about 0.88% of the total world production which was about 124.4 million tons[13]. Also, national citrus production accounted in 2003 for some of 2.5 % of the value of National Agricultural Output (NAO) and for 0.64 % of GDP. In 2002, 6% of national fruits and vegetable export value and 0.24% of total national merchandise export value derived from citrus fruits.

Table 3: Value of agricultural production at constant prices (million SP) 2005-2009 (basic year 2000)

Production	2000	2005	2006	2007	2008	2009 [1]
Plant Production	215382.5	248834.9	272163.1	227271.4	218686	247802.8
Fruits	65691.8	59717.3	85569.7	54530.7	67728.8	73883.5
Percentage of plant production value to total value of agricultural production [2]	63.9%	62.5%	62.9%	60.1%	61.4%	62.9%
Percentage of fruit production value to total value of agricultural production [3]	19.5%	15%	19.8%	14.4%	19%	18.7%
Total value of agricultural production	337098	398111.4	432712.9	378377.6	356209.7	394264.3

[1] Provisional Estimate

[2&3] calculated by researcher

Source: Elaborated from (CBS, 2005; CBS, 2010).

2.3 Citrus fruit cultivation in Syria

Citrus fruit trees are of the most important cultivated fruit trees in Syria, in the terms of economic, trade, and food. That is due to their limited planting in certain regions in addition to the great demand on the consumption of their fruits. The Syrian government sought in recent years to achieve self-sufficiency and export the surplus of production by:

1. Focusing on increasing the current productivity per area unit to reach 40 tons/hectare (see Table 9) through the provision of the optimum care for the citrus orchards and support of farmers to submit the different agricultural services correctly.

[13] In 2004, the Syrian citrus production was about 844.1 thousand tons. It accounted for about 0.8% of citrus fruits produced globally.

2. Increasing the area which is planted with citrus fruits to 50.000 hectares (Table 5), which is the arable area of citrus fruit after completion the establishment of irrigation canals on dams[14] and the reclamation areas of the wetlands.

2.3.1 Location of production, area and number of citrus fruit trees

Citrus fruit production is concentrated in two governorates, Lattakia and Tartous, where it grows on the coastal plain and on the lower slopes of the coastal hills up to 150 meters over the sea level (the Agro Ecological zone 1).

In 2009, Lattakia and Tartous accounted, respectively, for approximately 82% and 17% of total citrus production, 77% and 20% of the total area cultivated with citrus fruit trees, 74% and 22% of total citrus trees numbers. Small quantities of citrus fruit are also produced commercially in small areas in Homs, Idlib, Dar'a, Deir Ezzor, Hama and Al Ghab (Table 4).

Table 4: Area, production, and number of citrus trees by governorate for 2009 (Area: Hectare, Production: M. T., Number of Trees: Per Thousand)

Item	Production	Number of Trees		Area
		Fruit Bearing	Total	
Sweida	0	0	0	0
Dar'a	1578	105.5	111.4	264
Quneitra	0	0	0	0
Damascus	29	2.1	2.4	8
Homs	8926	194	215.2	605
Hama	431	45.3	50.5	63
Ghab	987	53,7	57.9	16
Idleb	2892	47.2	49	166
Tartous	185139	2476.4	2805.6	7675
Lattakia	892143	8319.6	9497.6	29525
Aleppo	14	0.5	0.5	5
Al-Raqqa	119	3.8	10.9	22
Dair-Ezzor	364	23.4	35.9	35
Al-Hassakah	0	0	0	0
Total	1092622	11271.5	12836.9	38383

Source: Elaborated from (AASA, 2010).

[14] These dams were built in the regions of citrus fruit cultivation.

In 2009, the total area planted with fruit trees was 977,815 hectares, accounted 17.3% of total cultivated lands. Of which 38,383 hectares were planted with citrus fruit and accounted 3.9% of the total planted fruit trees. Respectively, for nearly 17%, 59%, and 24% of the total citrus fruit areas were planted with lemon, orange and other citrus fruit types[15] (Table 5).

Table 5: Total cultivated area and the total area of fruit trees, total citrus fruit, orange, lemon and other citrus types (2000-2009), (Area: in hectare)

Item	Total Cultivated Area	Total Fruit Area	Total Citrus Area	Total Lemon Area	Total Orange Area	Total Other Citrus Types Area
2000	5352397	800232	27418	3672	13718	9960
2001	5449980	813302	28214	3836	14345	9967
2002	5420654	817172	28181	3984	15259	8938
2003	5478350	828893	29279	4835	16477	7967
2004	5525574	846833	31209	5249	17796	8164
2005	5562356	868003	31870	5368	18377	8125
2006	5587473	899262	33794	5659	19804	8331
2007	5682130	929497	35960	5929	21324	8708
2008	5666327	949854	37521	6096	22378	9048
2009	5664498	977815	38383	6456	22666	9261

Source: Own table based on (AASA, 2010).

According to Citrus Board Directorate in Syria, there is a governmental plan to expand the area planted with citrus, 500 hectare in average per annum. This plan depends on:

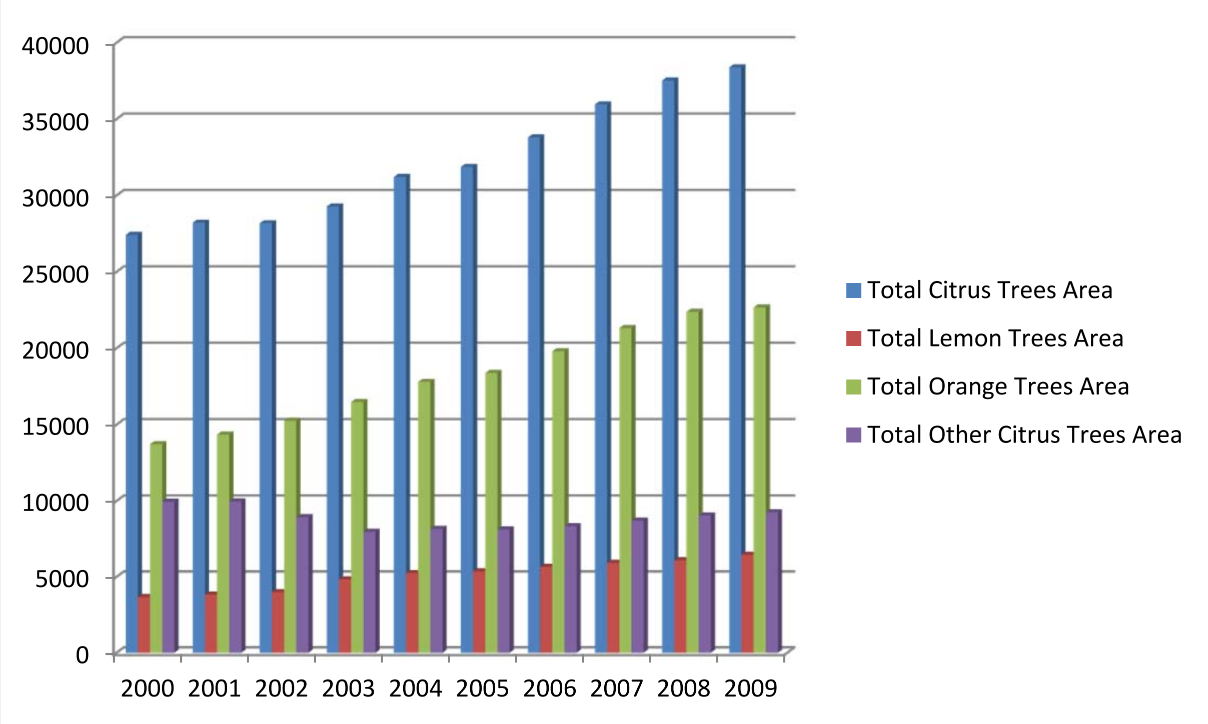
1. Renewal and replacement of the old orchards planted with citrus fruit trees with a new one.
2. Cultivation of citrus fruit trees in any farmland which is appropriate technically and climatically for citrus fruits growing. This included, for example, the expansion of the arable lands in Homs and Dar'a provinces; however, the yield per hectare will be low.

Figure 3 shows that the area planted with orange and lemon increased significantly between 2000 and 2009, while the areas planted with other citrus fruit types like grapefruit and

[15] Other citrus fruit refer to grapefruit, mandarin and other citrus fruit types except orange and lemon.

mandarin declined slightly during 2000 and 2003, and then began to increase very slightly until 2009.

Figure 3: Total cultivated area of citrus trees, orange, lemon and other citrus trees (2000-2009); (Area: Hectare)



Source: Own figure based on Table 5.

In 2009, the total number of citrus fruits trees was 12.84 million, of which approximately 11.27 million trees were in fruit. Almost 57% of the total trees planted with citrus fruit comprise various varieties of oranges, 87% of them were in fruit bearing. 18% of total citrus fruit trees comprise lemon, 87% of them in fruit bearing and 25% of total citrus fruit trees included grapefruit, mandarin and other citrus fruits types, of them 89% were in fruit bearing (Table 6).

Figure 4 shows that the number of orange and lemon trees, which were in the fruit bearing, increased significantly during 2000 and 2009, while the number of grapefruit, mandarin and other citrus fruit types (in fruit breading) declined slightly during 2000 and 2003, and then began to increase very slightly up to 2009. This is due to farmers switching into lemon in response to high domestic market prices and the introduction of a new, high-yielding disease-resistant variety. High yielding varieties introduced from abroad have progressively replaced local varieties which, in the case of oranges, are small in size, high in acidity, contain large numbers of seeds, and are relatively low yielding. Domestic consumers now prefer imported varieties such as Valencia. All the present varieties being distributed by the Citrus Board are based on imported stock. Source countries include California, Spain, Corsica and Sicily[16] .

Table 6: Number of citrus fruit trees and its types (2000-2009); (number of trees: per thousand)

Item	Number of Citrus fruit Trees		Number of Lemon Trees		Number of Orange Trees		Number of Other Citrus Trees	
	Total	Fruit Bearing	Total	Fruit Bearing	Total	Fruit Bearing	Total	Fruit Bearing
2000	10793	8129,8	1305,3	909,3	5389,7	4042,2	4074,3	3162,9
2001	10904	8410,5	1329,1	991,9	5458,1	4118	4093,1	3284,4
2002	9818,9	8592,5	1437,9	1209	5155,2	4467,2	3225,8	2916,3
2003	9966	8920,9	1768,4	1520,1	5427,2	4831,5	2770,4	2569,3
2004	10599,3	9443	1911	1676,1	5877,6	5093,4	2810,7	2673,5
2005	10817	9488	1974,1	1693,6	6027,2	5183,8	2815,6	2611,2
2006	11455,7	9988,3	2079	1800,9	6514,9	5534,8	2861,7	2652,5
2007	12105,4	10556,9	2154,9	1909,4	6968,9	5940,6	2981,6	2706,9
2008	12507,1	11087,4	2215,8	1941,6	7228,6	6349,1	3062,8	2796,6
2009	12836,9	11271,5	2329,8	2033,9	7322,3	6402,8	3184,8	2834,8

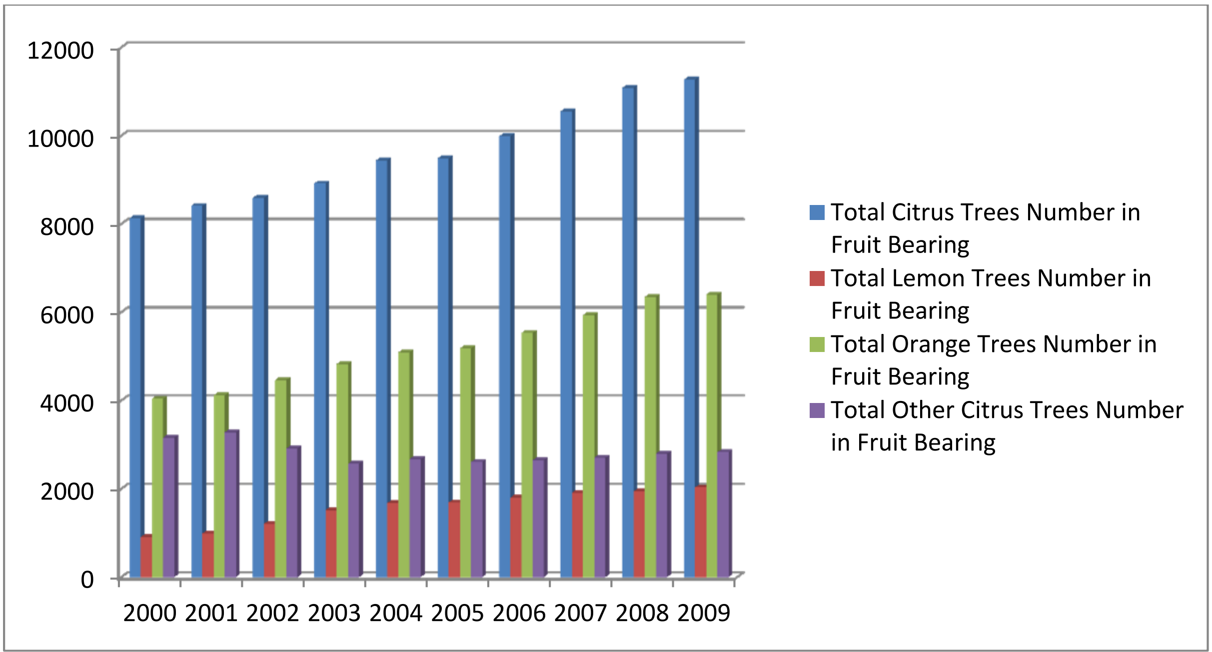
Source: Own table based on (AASA, 2010).

The annual governmental plan of increasing areas cultivated with citrus fruit trees includes cultivation of 200 thousand seedlings of different species and varieties of citrus fruit trees, which enter in fruit bearing after 5 years of planting[17].

[16] Interview with Ing. agr. Wajih Elmoei, Director of CBD; August 2005.

[17] Interview with Ing. agr. Ali Sulaeman, Head of Afforestation and Seedlings Department in the CBD, 2005.

Figure 4: Number of citrus fruit trees and its types which are in fruit bearing (2000-2009); (Number of Trees: per thousand)



Source: Own figure based on Table 6.

2.3.2 Types and varieties of citrus fruit

The types of citrus fruit trees, which are cultivated in Syria, can be divided into four groups: orange, lemon, mandarin and grapefruit and pomelo (CBD, 2005)[18].

<u>Orange Group:</u>

1. **Navel oranges:** Early maturing variety, primarily used for eating, seedless, less juicy and their fruits vary in shape and form of the navel, which located at the bottom of fruit, by strain:

   - Washington or California Navel: Fruit is spherical, slightly prolonged, and the navel is large and clear.
   - Gillata Navel: Fruit is spherical with large and discriminant navel.
   - Attood Navel: This strain is derived from Washington Navel strain, but its fruit is spherical.
   - Navelina: Fruit is spherical, prolonged slightly and the navel is small and discriminant.

[18] The information of this section based on unpublished extension program issued by Citrus Board about the cultivation of citrus fruit in Syria.

- Nowhall Navel: Fruit is prolonged with small discriminant navel; this strain is very early in maturity.

2. **Hamlin orange:** Early-season juice orange with a few seeds in the fruits, good for shipping and storage, high-yielding and unaffected by the biennial yield pattern.

3. **Acidless oranges:** They are an early-season fruit with very low levels of acid, high-yielding variety and multi seeds. It is also called **Succari** in Syria.

4. **Cadanera orange:** Early-medium maturing variety, seedless, juicy and good for storage and shipping.

5. **Maltaise orange:** Medium-late maturing variety, nearly seedless, fruit color is red when it ripens, medium-yielding. It has a tendency to biennial yield pattern and is not good for storage and shipping.

6. **Jaffa oranges:** Medium-late maturing variety, primarily used for eating, nearly seedless, tendency to biennial yield pattern. It is very important variety for export.

7. **Valencia orange:** It is one of the sweet oranges used for juice extraction. Since it is a late maturing variety it is a popular variety when the navel oranges are out of season.

8. **Blood oranges:** Called **Mauardi** in Syria, characterized by dark red pigmentation. They are considered, in general, the most delicious juice orange.

9. **Baladi oranges:** Domestic variety.

10. **Khettmali oranges:** Domestic variety.

Many species and varieties of oranges were introduced recently in the governmental plan of expansion in the cultivation of citrus fruit. Most of them are used primarily for juice production.

Lemon Group:

1. **Monachello:** Medium maturing variety, very thorny tree, high-yielding, juicy fruits, two main seasons in spring and winter. Recently, CBD has imported a new strain of this variety with few thorns on the trees.

2. **Eureka:** High-yielding, juicy fruit and high-acidity variety. It is the common product in the supermarket because it is available during different seasons of the year.

3. **Improved Meyer:** Multi-seasons variety: its fruit is juicy but its acidity decreases when it is stored or left on the trees beyond the period of natural maturation.
4. **Femminello:** Multi-seasons, high-yielding, juicy fruit and high-acidity variety.
5. **Lisbon:** Multi-seasons, high-yielding, medium-juicy fruit and high-acidity variety.
6. **Villafranca:** Multi-seasons variety, its fruit is similar to Eureka's one.
7. **Sassli:** Local variety, it fruits in spring. Its fruit is similar to Eureka's variety.
8. **Santa Teresa:** Strain derived from Femminello variety; the color and size of its fruit are good. It is a high-yielding and juicy variety.
9. **Lime:** Multi-seasons, high acidity and very juicy variety; its fruit size is small-medium. Lime variety has a lot of strains in Syria like: Mexican Lime and Tahiti's Lime.

Mandarin Group:

1. **Satsuma:** Early maturing, sweet and seedless variety. It has bad storage characteristics. It has also many strains like: S. Wase, S. Owari, S. Saigon and S. Sain jean.
2. **Clementine:** Early-medium maturing variety; good for shipping and storage. Its fruit contains few seeds and it has many strains like: C188, C138, C136 and C163. It has also a lot of hybrids.
3. **Tangerine:** Late maturing variety. It has a lot of hybrids. Its fruit is very small. And usually much easier to peel and to split into segments. The taste is often less sour, or tart, than that of an orange. Peak tangerine season is short, lasting from October to April in the Northern Hemisphere. Clementine is the popular alternative to tangerine, which is called seedless tangerine.
4. **Fremont:** Early maturing hybrid, very juicy, multi-seed and suitable for shipping and storage.
5. **Fairchild:** Early maturing and sweet hybrid.
6. **Tangelo Nova:** Very early maturing hybrid, multi-seed and juicy.

7. **Page Mandarin:** Early maturing hybrid.

8. **Mandarin Forton:** Late maturing hybrid.

9. **Carvalhais Mandarin:** Very early maturing hybrid.

10. **Ponkan:** Medium maturing variety. It has a tendency to a biennial yield pattern and loses some of its specifications if it is not picked at the accurate time of its maturity.

11. **Wilking:** Medium maturing hybrid.

12. **Murcott:** Medium-late maturing, juicy and multi-seed variety.

13. **Kinnow:** Juicy hybrid.

14. **Dancy Tangerine:** Medium maturing variety. It loses a lot of its specifications if it is not picked at the accurate time of its maturity.

15. **Mandalina:** Local, medium maturing variety. It is not suitable for shipping and storage.

16. **Yousef Effiendi (Baladi):** Local, medium maturing variety. Its fruit is small, very juicy and with rich flavor; it is also small and multi-seed. This variety has strong tendency to biennial yield pattern**.**

17. **Kara:** Late maturing hybrid. Its fruit is very juicy and with rich flavor. It has weak tendency to biennial yield pattern.

18. **Ortanique:** Late maturing hybrid. Its fruit is large and cohesive. This hybrid is suitable for shipping and storage.

19. **Malvasio:** Very late maturing hybrid. Its fruit is juicy and multi-seed; it also has good storage specifications.

20. **Temple (Tangor):** Medium-late maturing variety. Its fruit is multi-seed and its juice has good flavor.

21. **Minneola:** Medium-late maturing hybrid. Its fruit is very juicy.

22. **Orlando Tangelo:** Early maturing and multi-seed hybrid.

23. **Pixie:** Late maturing hybrid. Its fruit is small, medium juicy and contains few seeds.

Pomelo (Pummelo):

Pomelos are the largest citrus fruits (much larger in size than grapefruit). Pomelo and its hybrids' color, including the grapefruit, is pale green to yellow when ripe, with very thick albedo. Its flesh usually is sweet and white. Its weight when ripe is 1-2 kg. There are other names of pomelo used in Syria like Shaddock and Chinese grapefruit.

Grapefruit Group:

Grapefruits are hybrids of pomelos and it is very important in the terms of industry and commerce. Its importance has increased especially after its promotion as a diet drink. Where Its pulp and inner peel are used by the food industry in the preservation of other fruits and making jams and marmalades. Also its pulp is an important source of grapefruit oil, which is used as a flavor in many soft drinks like tonic-water. Its inner peel is an important resource of pectin and citric acid.

The most important grapefruit varieties which are cultivated in Syria are:

1. **Marsh G.:** Late maturing variety; its fruit has white or pale yellow flesh; seedless and juicy. This variety is good for shipping and storage.

2. **Red Blush G.:** Medium maturing variety; its fruit has pink flesh.

3. **Thompson G.:** Medium maturing variety; its fruit is seedless; juicy and has pink flesh. This variety is good for shipping and storage.

4. **Shambar G.:** Early-medium maturing variety; its fruit is seedless and has dark pink flesh.

5. **Star Ruby G.:** Early maturing variety; its fruit is seedless, juicy and has a dark red flesh. This variety is good for shipping and storage.

Types and varieties of citrus fruit which are cultivated in Syria can be divided into three divisions according to their consumption channels:

1. Domestic consumption: includes different species and varieties of orange, mandarin, lemon and grapefruit.

2. Export channel: is provided with the following types and varieties:

   Orange Group: Navel, Jaffa, Valencia and Hamlin.

Lemon Group: Monachello and Eureka.
Mandarin Group: Satsuma, Clementine and other hybrids.
Grapefruit Group: White, pink and red grapefruit.

3. Processing channel: is provided with the following types and varieties:
   Orange Group: Baladi, Khettmali, Hamlin, Valencia and Blood oranges (Mauardi).
   Lemon Group: All its types and varieties.
   Mandarin Group: Clementine and other hybrids.
   Grapefruit Group: All its types and varieties.

2.3.3 Evolution of Syrian citrus fruit production

Syrian citrus fruit annual production data between 1970 and 2009 are presented in Table 7[19] and Figure 5.

Figure 5 shows that citrus fruit production during 1970-1990 was relatively low; however, it has increased more than 100 times over the past 40 years as a result of carefully considered efforts by the Syrian government to lay the groundwork for citrus fruit as an important crop. This was accomplished through many procedures like[20]:

1. The insertion and authentication of new, higher yielding varieties.
2. Programs to support land reclamation, seedlings and requirements of the production processes.
3. Introduction of free long-term credit from 1977 to 1993 to the citrus fruit farmers.
4. Free extension assistance.
5. Insertion of integrated pest management.

These governmental standards, which were coupled with high domestic market prices, made citrus fruit crop very profitable.

In the early eighties of the last century, Syrian Arab Republic suffered difficult economic conditions as a result of the economic and political embargo imposed by the United States; therefore, the Syrian government decided to develop a comprehensive system of national production planning. The target of this system was to achieve economic self-sufficiency of various products to ensure food security for the Syrian people. This system was an incentive

[19] SMAAR, the AASA 1975, 1980, 1985, 1990, 1995, 2000 and 2005

[20] An interview with Ing. agr. Wajih Elmoei, Director of CBD; August 2005

to spread out the cultivation of citrus fruit and other important strategic crops such as wheat, barley, lentils, chickpeas, cotton, sugar beet and tobacco in Syria (Westlake, 2001).

Recently, the SMAAR reduced the agricultural areas which were planted with wheat and cotton to commensurate with the manufacturing capacity. It adopted a policy of transition from the horizontal expansion at the level of the cultivated areas to the vertical expansion. That was due to the limited of resources available and the trend towards varieties tolerant to drought and had high productivity. An additional reason was to consolidate the use of modern technologies in irrigation, which will save about 40 percent of the water. In order to achieve these goals, SMAAR developed the agricultural plans in partnership with the ministry of irrigation. This policy was accompanied by a remarkable increase in the production of vegetables and citrus fruit, which exceeded one million tons in 2009[21].

Table 7: Syrian citrus fruit trees production, 1970-2009; (Production in M. T)

Year	Lemon	Orange	Other citrus	Total
1970	1.435	3.868	2.186	7.760
1975	4.356	13.259	8.502	26.819
1980	8.632	31.434	21.804	63.025
1985	10.294	34.618	35.970	80.789
1990	34.847	153.651	164.845	350.355
1995	49.577	303.086	213.039	565.702
2000	83.469	407.066	309.455	800.000
2001	79.427	464.894	288.642	833.449
2002	84.889	427.148	234.148	746.185
2003	71.420	398.771	182.340	652.531
2004	111.508	495.520	237.067	844.095
2005	111.042	452.622	214.153	777.817
2006	118.832	554.135	234.049	907.016
2007	130.627	602.933	233.310	966.870
2008	137.345	657.698	251.413	1.046.456
2009	140.647	689.751	262.224	1.092.622

Source**:** own table based on (AASA, several years).

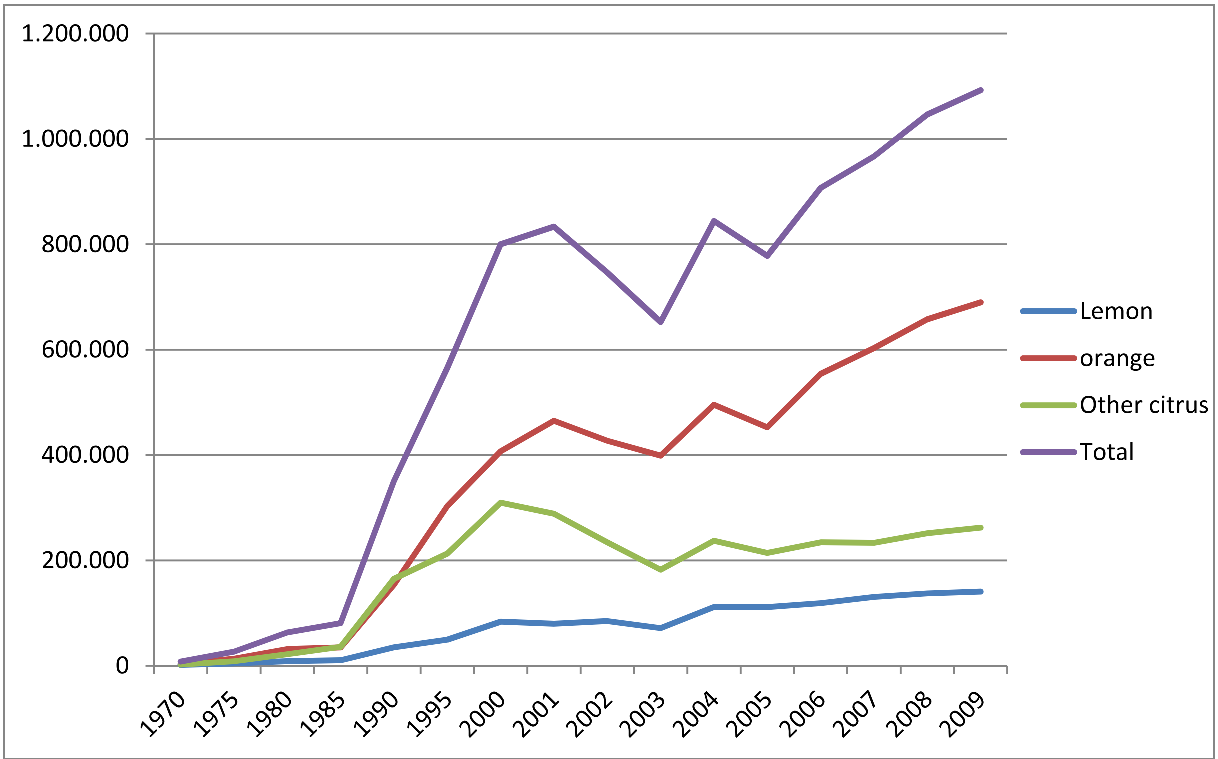
The national production planning system for citrus fruit starts at the level of village[22], where each one prepares a production plan which reflects the guidelines of government. These plans

[21] SANA 22.10.2009, Interview with Dr.-Ing. agr. Adel Safar: the former Minister of SMAAR and the current Syrian Prime Minister. URL: http://www.sana.sy/ara/2/2009/10/22/251275.htm.

[22] It depends on the cooperation between Agricultural Extension Units (AEU) and citrus fruit growers.

are aggregated progressively at villages' level, and region level then province level to reach finally the SMAAR which presents them in one plan to the Supreme Agricultural Council (SAC) for approval. Now, citrus fruit growers can choose the types and varieties of citrus fruit that they want to cultivate, but they are also constrained by the set of seedlings that is produced by the Citrus Board. This production of seedlings is now the most important tool to direct growers towards cultivation of certain types and varieties of citrus fruits. However, there is no control of regrafting which allows farmers to switch from one type and variety of citrus fruit to another[23].

Figure 5: Syrian citrus fruit trees production, 1970-2009; (Production in M. T)



Source**:** own figure based on the Table 7.

2.3.4 Average annual growth rates of citrus fruit production in Syria

Average annual growth rates of Syrian citrus fruit production of all types (orange, lemon and other citrus fruit in volume terms) varied considerably over different years between 1970 and 2009 (Table 8). In the time period between 1970 and 1985, the average annual growth rate (AAGR) of citrus fruit production decreased progressively and significantly due to several

[23] Recently, some citrus growers have regrafted trees within their orchards with those cultivars that are presently fetching comparatively high prices, as a result of recent increase in the prices of citrus fruits in the markets. Regrafted trees need 3 years, at least, to come back into fruiting. The estimated percentage of regrafted trees has ranged from as little as 1% to as high as 10% during the last ten years. Interview with experts in the CBD; 2006

factors, mainly climatic conditions, in particular frosts (Venner and Blank, 1995) which Syria had suffered during that period[24]

Table 8: Average annual growth rates (in %) of citrus fruit production in Syria

	Lemon	Orange	Other citrus	Total
1970-1975	25%	28%	31%	28%
1975-1980	15%	19%	21%	19%
1980-1985	4%	2%	11%	5%
1985-1990	28%	35%	36%	34%
1990-1995	7%	15%	5%	10%
1995-2000	11%	6%	8%	7%
2000-2005	6%	2%	-7%	-0,6%
2005-2009	6%	11%	5%	9%

***Source*:** own calculation based on data in the Table 7[25].

AAGR of the production of all citrus fruit types increased dramatically during the time period 1985-1990 to reach the maximum peak (Figure 6). This was facilitated by a combination of factors:

1. Self-sufficiency plan which was developed by the Syrian government in the eighties of the last century.
2. Horizontal expansion[26] in the cultivation of citrus fruit.
3. Beginning to introduce modern technologies.
4. Applying the biological control programs.

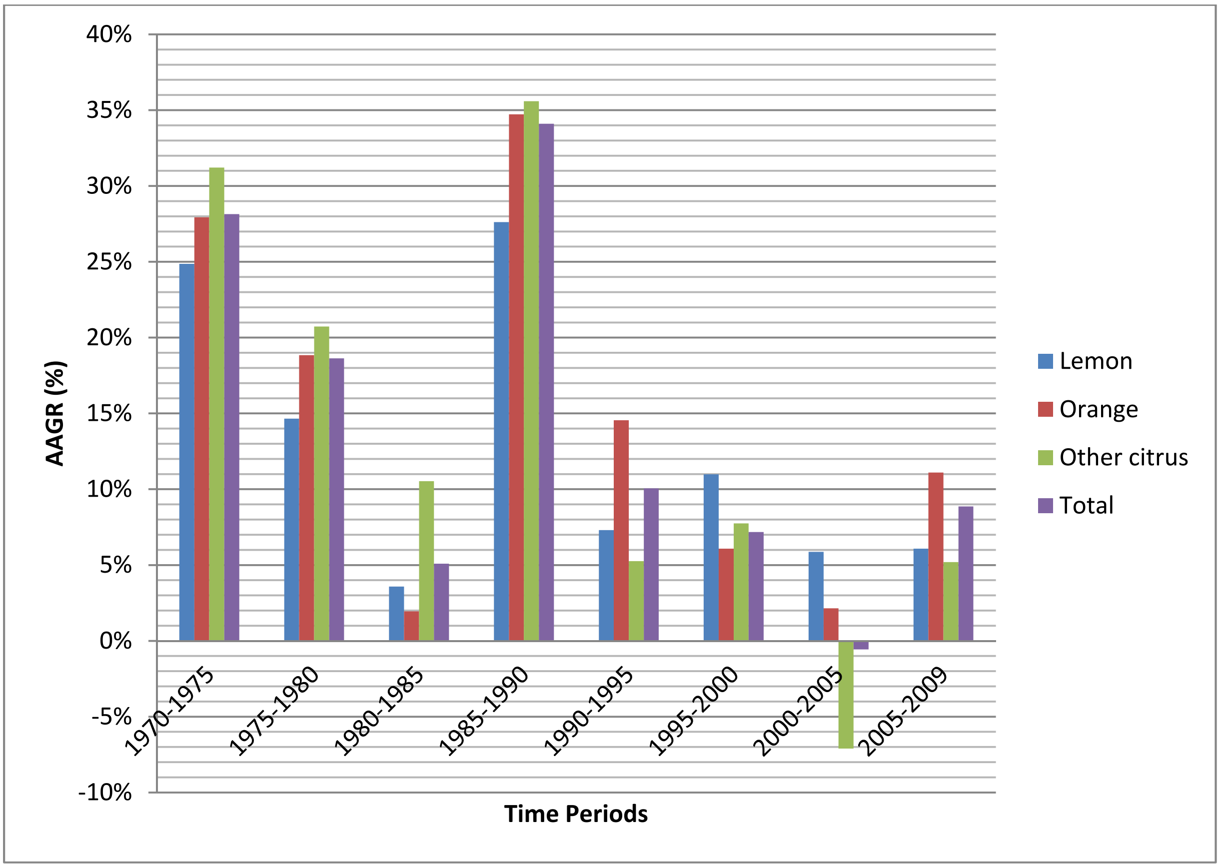
In the time period between 2000 and 2005, the AAGR of all citrus fruit types reached the minimum peak. It was negative for the total output of citrus fruit trees production (-0.6%), as well as for the other citrus fruit (-7%), (Figure 6). This decline was, mainly, due to the drought which hit Syria during this time period and lasted until 2008.

[24] In 1985 for example, the coastal regions of Syria (Where citrus fruit cultivation is concentrated) had experienced a very hard frost led to loss a large quantities of citrus production (CBD, 2005).

[25] Data in the (Table 8) was calculated by using the following formula: $AAGR_{(t_0\ ,t_n)} = (\frac{v_{(t_n)}}{v_{(t_0)}})^{(\frac{1}{t_n - t_0})} - 1$

[26] By increasing the areas planted with citrus fruit trees.

Figure 6: Average annual growth rates (in %) of citrus fruit production in Syria



Source**:** own figure based on the Table 8.

2.3.5 The instability of Syrian citrus fruit productivity

Productivity per hectare of citrus fruit trees in Syria fluctuates from year to year. The climatic conditions (like frost and drought) and the biennial yield pattern play very strong roles in this fluctuation. The biennial yield pattern is pronounced in the case of orange trees more than the case of other citrus fruit types.

Instability of the citrus fruit trees productivity is shown in the Table 9 and in the Figure 7. In the time period between (1985- 2000) there was a strong upward trend in the productivity per hectare of citrus fruit trees due to the implementation of the gradual improvement programs of citrus fruit seedlings husbandry and the introduction of new imported varieties[27]. In 2001, the citrus fruit productivity per hectare began to decrease until 2003, especially in the case of lemon trees.

[27] Interview with Ing. agr. Ali Sulaeman, Head of Afforestation and Seedlings Department in the CBD, 2005

Table 9: Productivity of Syrian citrus fruit trees, 1985-2009; (Yield in M. T. / Hectare)

Year	Lemon	Orange	Other citrus	Total
1985	6,80	6,69	6,84	6,77
1990	16,75	18,08	15,97	17,00
1995	17,59	24,59	21,12	22,42
2000	22,73	29,67	31,07	29,18
2001	20,71	32,41	28,96	29,54
2002	21,31	27,99	26,20	26,48
2003	14,77	24,20	22,89	22,29
2004	21,24	27,84	29,04	27,05
2005	20,68	24,63	26,36	24,41
2006	21,00	27,98	28,09	26,84
2007	22,03	28,28	26,79	26,89
2008	22,53	29,39	27,79	27,89
2009	21,79	30,43	28,31	28,47

***Source*:** own table based on SMAAR, the AASA various years

Table 10 shows that the AAGR of citrus fruit productivity in Syria was about 20% for all types of citrus fruit during the time period between 1985 and 1990[28]. But it went down significantly during the time period 1990 and 2000 where it remained stable at 5,5% on average.

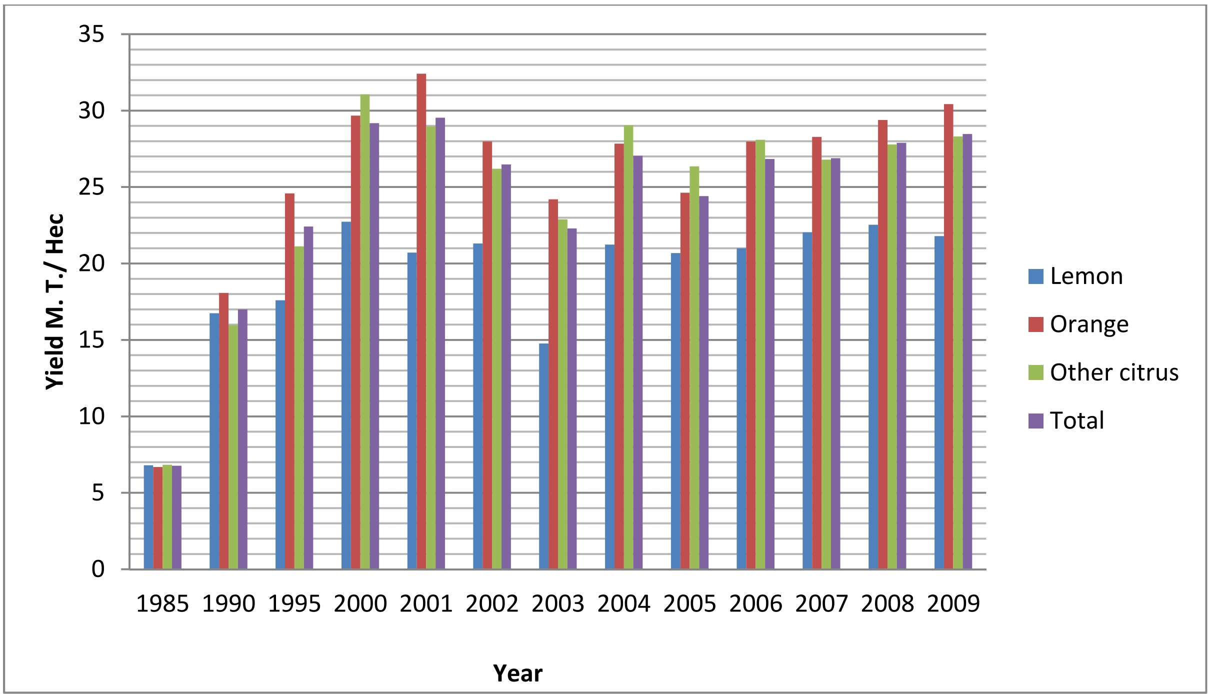
Table 10: Average annual growth rates (in %) of citrus fruit productivity in Syria

	Lemon	Orange	Other citrus	Total
1985-1990	20%	22%	18%	20%
1990-1995	1%	6%	6%	6%
1995-2000	5%	4%	8%	5%
2000-2005	-2%	-4%	-3%	-4%
2005-2009	1%	5%	2%	4%

***Source*:** own calculation based on data in the Table 9.

[28] AAGR of the production of all citrus fruit types reached its maximum peak during the same time period between1985-1990.

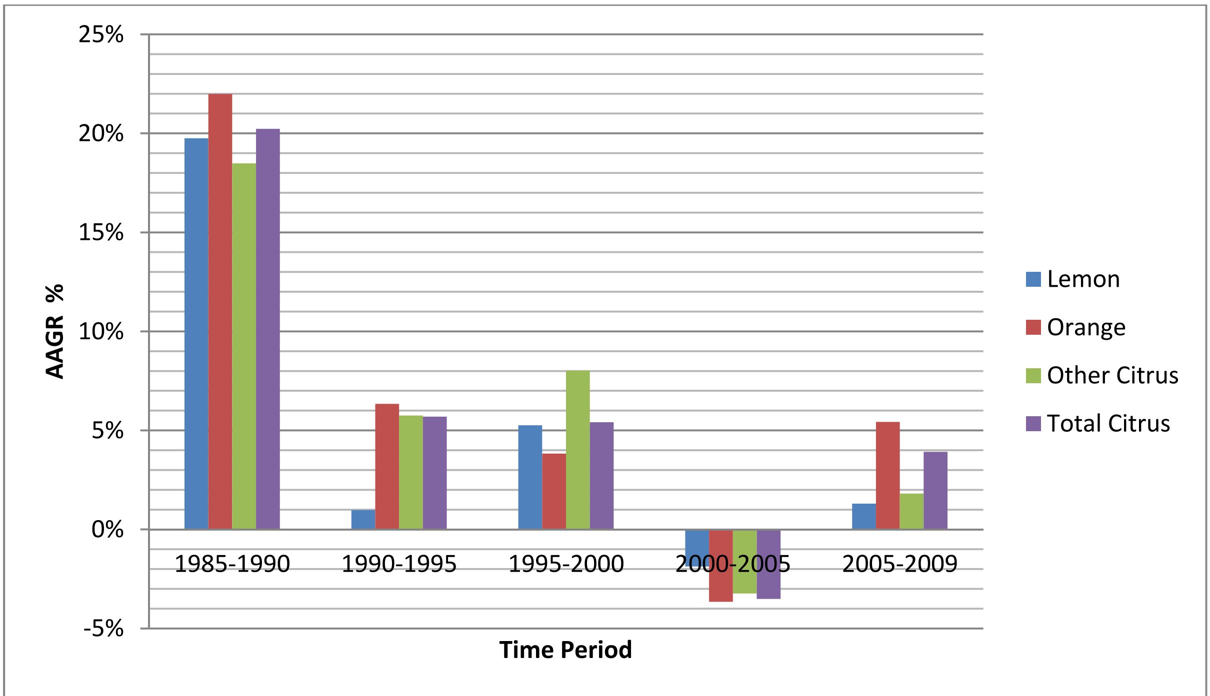
Figure 7: Productivity of Syrian citrus fruit trees, 1985-2009; (Yield in M. T. /Hectare)



Source: own figure based on the Table 9.

Between 2000 and 2005, the AAGR was negative for all types of citrus fruit trees (Figure 8). This negative rate was accompanied by a sharp decline also in the AAGR of citrus fruit production during the same period (figure 6).

Figure 8: Average annual growth rates (in %) of citrus fruit productivity in Syria



Source: own figure based on the Table 10.

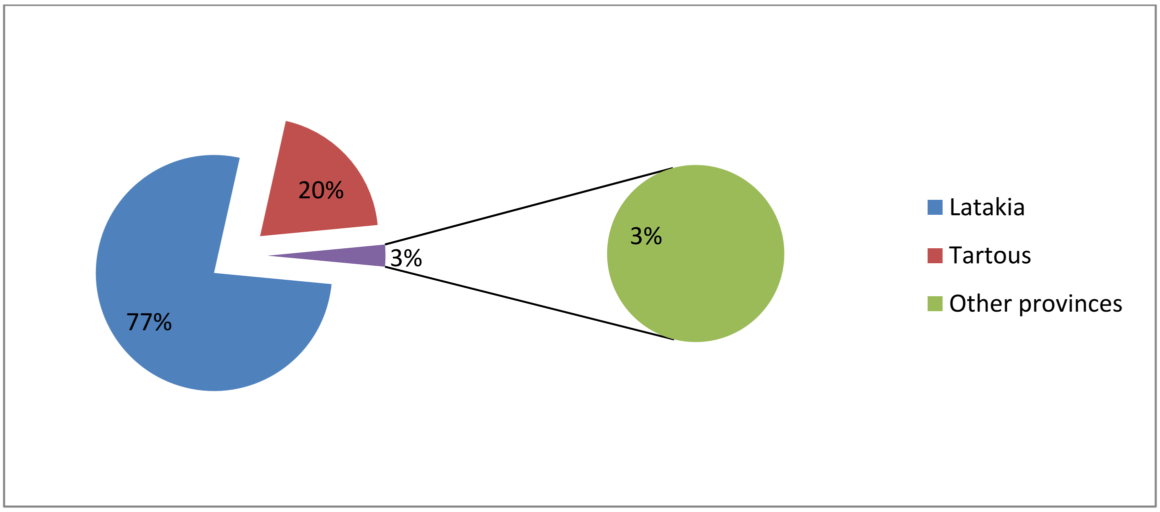
2.3.6 Classification of citrus fruit farms in Syria

In Syria citrus fruits are produced by more than 30,000 private farms[29]. Most of them are located in Lattakia and Tartous provinces, about 77% in Lattakia and 20% in Tartous (Figure 9).

Citrus fruit Farms in Syria are classified according to their area to[30]:

1. Small-scale farms with areas less than 5 dunams[31]. These farms constitute about 20% of total citrus fruit farms number.
2. Medium-sized farms with areas between 5 and 15 dunams. Farms with these areas constitute about 70% of total number of citrus fruit farms in Syria.
3. Large-scale farms with areas of more than 15 dunams. These farms constitute about 10% of total citrus fruit farms number.

Figure 9: Distribution of citrus farms in Syria by the provinces



***Source*:** Own figure based on the Table 4.

The average number of citrus fruit trees planted per hectare is about 350 trees. Consequently, citrus fruit farms are classified according to the trees number planted to:

1. Small farms with less than 150 trees.
2. Medium farms that have from 150 to 525 trees.
3. Large farms with more than 525 trees.

[29] Interview with Ing. agr. Mahmoud Ali, Department of Agricultural Affairs, Directorate of Agriculture, Tartous, 2006

[30] Interview with Ing. agr. Ali Sulaeman, Head of Afforestation and Seedlings Department in the CBD, 2005

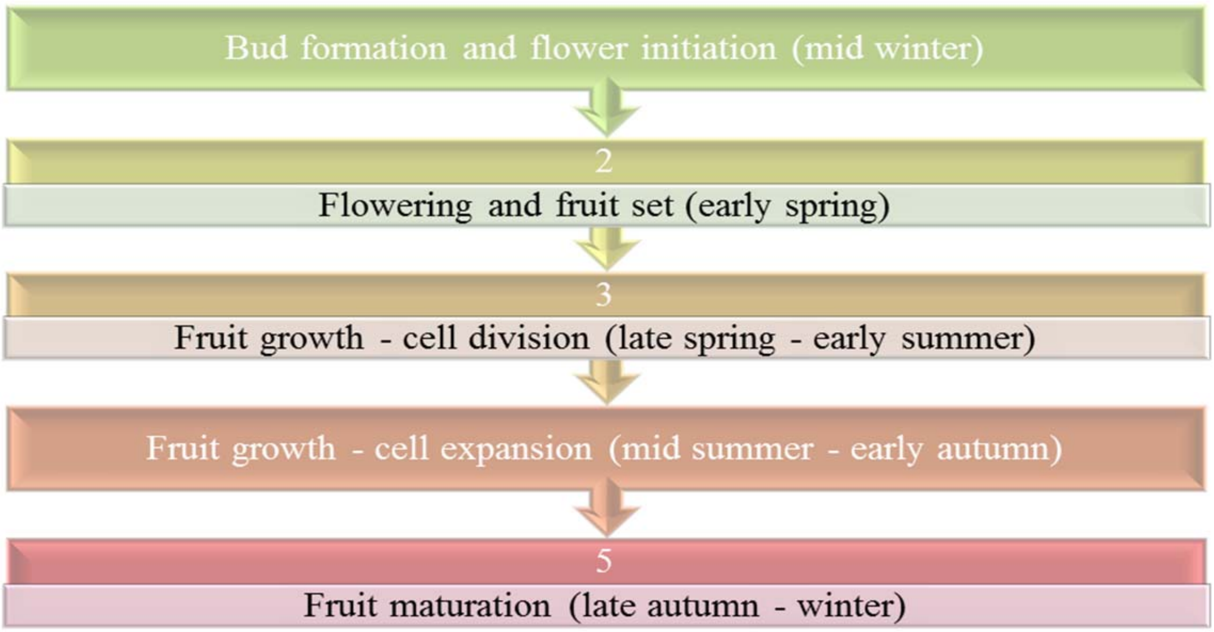
[31] A metric dunam is equal to: 1,000 square meters (exactly) and 0.1 hectares (exactly).

2.3.7 Environmental factors affecting the success of citrus fruit cultivation

Fruits of citrus trees grow through a succession of phases throughout the year. In regions, where there is only one type of cultivated citrus fruit, the timing of maturation phases would be distinctive to a certain extent. However in districts where multiple citrus fruit crops are cultivated different phases of maturation would be occurring at the same time. The typical succession is clarified in (Figure 10).

Agricultural environment means the surroundings area that plants lives in, including the surrounding climatic elements, living beings and the soil in which plants are grown. Plant growth is the outcome of the plant genetic structure and the environment, where the surrounding environmental factors could be the main reason of the possibility or impossibility of plant cultivation in a certain region (specific factor) (CBD, 2005)[32].

Figure 10: Typical succession of citrus fruit maturation phases throughout the year



***Source*:** own figure after (CBD, 2005).

<u>The impact of temperature degrees:</u>

The lowest temperature in an area is the most important determinant of the citrus fruit cultivation success. It is affected by latitude, longitude, the elevation above sea level, the proximity to warm water surfaces and wind currents etc. It led to a spread of citrus fruit

[32]. The information of this section based on unpublished extension program issued by Citrus Board about the cultivation of citrus fruit in Syria.

cultivation in the Mediterranean region between latitudes 35° N and 44 ° N. In general, citrus fruit is planted in tropical and subtropical regions with mild winter temperatures.

The temperatures of -2 - +2 °C and below can be considered as very harmful to the citrus fruit trees, especially if they are exposed to these degrees for a long time. The aspects of the damage which are caused by low temperatures are:

1. Extensive damage of the flowers and the newly setting fruits causing their downfall.
2. Drying of the recent grown branches and cracks in the bark of trees.
3. Causing damage to the big branches and trees may die down to the ground level.

Frost is resisted by:

1. Planting windbreaks.
2. Narrowing the cultivation spaces between trees.
3. Protection of the bushes and seedlings of cold by covering them.
4. Warming trees during the cold nights by using special stoves or by using ventilators to move air above the trees level.

Citrus fruits begin to grow at temperature of 13 – 18 °C, the maximum growth occurs at temperature of (32 – 35) °C. The higher the temperature above 35 °C the less the growth rate. No growth at all occurs above 48 °C. This causes damage of both vegetative and fruiting growth but citrus cultivation regions rarely reach such high temperatures.

The impact of relative humidity:

Relative humidity[33] is the amount of water vapor in a space of air attributed to the amount of water vapor that saturates this space at the same temperature (Moyers and Baldwin, 1999).

Declining of relative humidity leads to:

1. Increase of the damage which is caused by high temperatures.
2. Increase of transpiration.
3. Increase of the inability of roots' water absorption which leads to water imbalance.

Then plant starts to get rid of some organs to maintain its life (falling off flowers and small fruits, dry of apical branches and leaves, dry of the recent cultures and combustion of the exposed parts of the fruit cortex). As a result, the economic value will tend to decrease and a

[33] RH = 100p/ps.

significant loss in yield will occur. The damage caused by low humidity and can be reduced by using the means which are used to resist high temperatures as well as by using sprinkler irrigation systems and cultivation of ecological crops[34] which help to raise the relative humidity.

Increase of the relative humidity causes: various fungal and insect diseases, it leads to decrease the fructose and acidity proportion in the fruit, and consequently, it will be responsible of the poor taste in the fruits.

The impact of light:

Citrus tree is one of the short-day plants, but it can become one of the long-day plants if it is provided with the required care of irrigation and fertilization; as light is one of the less weather factors which affect the success of citrus fruit cultivation. Generally, citrus fruit trees need moderate light intensity (more than 70%) and an average of daily temperature of 15 – 16 °C during the strong growth of branches and fruits. The higher light intensity is affected on the growth and fruiting of the citrus trees. Also the lack of light and deficiency of its access to the heart of tree (as a result of overcrowded trees which is caused by less care of pruning) prevents flowering and hence the productivity of trees will be very low.

The impact of wind:

Wind is an important factor for success of the citrus fruits cultivation, especially in the regions that are exposed to the sirocco wind[35]. The damage which is caused by wind with high relative humidity is less than the damage which is caused by hot and dry wind. This damage reflects in many ways (Albrigo, 1976; Grafton-Cardwell *et al.*, 2003; Owen-Turner and Hardy, 2006):

1. Mechanical damage caused by strong winds: It conduces to the fall of leaves, flowers, fruits, and break of branches. Also strong wind may lead to uprooting of trees especially in the regions with light soil, and this damage will increase if this strong wind comes directly after irrigation.

[34] Ecological Farming is: "*A system ensures healthy farming and healthy food for today and tomorrow, by protecting soil, water and climate, promotes biodiversity, and does not contaminate the environment with chemical inputs or genetic engineering*" (Tirado, 2009) .

[35] It is a Mediterranean wind that comes from the Sahara and reaches hurricane speeds in North Africa and Southern Europe and sometimes hits Syrian lands. URL: http://en.wikipedia.org/wiki/Sirocco.

2. Physiological damage caused by sirocco wind: It leads to impair the water balance of trees due to increased evapotranspiration[36], as a result of the rapid passage of the wind over the surfaces of leaves, fruits and young branches and the disability of roots to absorb water. This damage will increase whenever the wind is dry and hot. Then the tree will absorb the water from fruits and thereby a separation lay will be formed in the fruit. Finally, tree will show signs of thirst and withering of peripheral vegetative branches, flowers and fruits leading to distortion of their appearance and at the end they will fall causing big economic loss to the growers.

3. Other damages: Wind may also hinder the operations of pollination by insects. That leads to decrease the setting fruits and sometimes interfere with operations of agricultural services such as spray irrigation.

2.4 Citrus fruit quality

The perception and meaning of quality varies from one person to another. However, the combination of fruit attributes or characteristics could be defined the fruit quality which significantly determines the degree of consumer acceptance. This means that the better the quality, the higher the rate of acceptance and vice-versa. To control quality[37], certain standards are settled. The quality inspectors evaluate the quality of fruits and decide their grade, utility and marketability according to these standards. Also, quality evaluation and control are necessary to set the fruit price. Quality control starts in the field and may take place at several levels of fruit handling and marketing. According to Ladaniya (2008) there are a lot of methods to evaluate the quality characteristics, such as:

1. Objective methods: These methods are accurate and depend on the use of instruments.
2. Subjective methods: These methods are depending on the response of human senses to external and internal fruit quality.

Other methods, which are depending on whether fruit is destroyed (cut or punctured) during analysis or remains intact, could be also assembled into (Abbott, 1998):

[36] Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves. URL: http://en.wikipedia.org/wiki/Evapotranspiration.

[37] Quality refers to the quality of all food items including fresh citrus fruits and other perishables.

1. Destructive methods: Most of the conventional quality evaluation methods are destructive. In this method a representative sample is taken and it is lost during assessment.

2. Non-destructive methods: These methods can be used to monitor quality when the fruit is still attached to the tree or after harvest to make sure that every fruit sent to the market meets the quality standards.

The quality characteristics and evaluation methods could be also classified into three groups: physical, chemical, and physiological:

1. Physical characteristics, such as rind color, rind thickness, fruit firmness, fruit shape, fruit weight, fruit volume, rag percentage, juice percentage, total soluble solids (TSS), and specific gravity. All these characteristics are measured by using rules of physics and measuring the response of fruit to light, weight, force, time, space distance etc. They are the most important factors in the design of grading, handling, processing and packaging systems (Sahraroo *et al*., 2008; Ladaniya *et al*., 2011).

2. Chemical characteristics: These quality characteristics for citrus fruit include total titratable acidity, ascorbic acid, total sugars, reducing and non-reducing sugars, and PH. They are measured by using specific rules of chemistry which depend on response of the fruit's internal composition to chemical reactions. These chemical characteristics give good information about fresh fruit quality, especially taste and nutritive value.
3. Physiological characteristics: They include CO2 evolution or O2 consumed (rate of respiration), ethylene evolution, rate of transpiration or water loss from fruit, rate of enzymatic reaction, growth regulator and hormonal content, and gaseous content of fruit (CO_2, O_2, and C_2H_4). Analysis of these attributes gives good information about fruit quality, especially the stage of fruit maturity and aging (Agusti *et al*., 2002).

2.4.1 External and internal quality

The external and internal quality of fresh citrus fruit is requisite after harvesting and until the fruit reaches the consumer. Most of the external quality factors are largely related to the senses of vision and touch which are determined by the fruit appearance (their evaluation methods are subjective). There are twelve quality parameters that affect citrus fruit appearance: (1) rind color, (2) rind texture, (3) discoloration, (4) blemishes (scars resulting from wind or twig rubbing, scab, scales, melanose[38], stem-end injury, or any other insect damage), (5) bruises resulting from transport or other factors, (6) oleocellosis[39], (7) oil-spry injury, (8) hailstorm injury, (9) sunburn, (10) creasing, (11) rind breakdown, and (12) puffing.

The internal quality of fruit is regulated in general by flavor[40], color of juice and flesh, appearance, and mouth-feel. All these quality properties are determined by the chemical composition. The suitable mix of sugars and acids gives citrus fruit its acceptable taste more than anything else. Mouth-feel is another important quality attribute which is a result of viscosity and the presence of water-insoluble solids. Also pectin, water-insoluble solids and fibers influence the firmness of citrus fruit sections (Ladaniya, 2008).

Despite the fact that the environmental conditions are playing the major role in determining the success of citrus fruits cultivation in a particular region and hence the identification of fruit quality, but the internal and external quality characteristics of citrus fruit are affected by many other factors. Some of these factors are (Sinclair, 1984):

1. Variety and the selections of rootstock.
2. The age of citrus trees.
3. Management practices of the farm and their impact on the quality of tree service operations (nutrition, pruning, irrigation, pests and diseases control and the use of windbreaks etc.).

Another definition of the external quality refers to the external physical characteristics of the fruit in the terms of size, shape, color, and blemish which are influenced by a lot of factors[41]:

[38] Melanose is a disease of citrus trees and fruits caused by an imperfect fungus (*Diaporthe citri*) that produces hard brown raised and often gummy spots in the rind of the fruit and also on twigs and leaves. URL: http://www.merriam-webster.com/dictionary/melanose.

[39] 'Oleocellosis is a physiological rind disorder of citrus fruit that is caused by the action of phytotoxic rind oils on the rind tissue. These oils are released from glands located in the rind following mechanical damage to the fruit. It can result from various types of damage, such as insect attack, hail damage or wind rub, and it can also develop in undamaged fruit that come into contact with damaged fruit. The oleocellosis-damaged rind has a sunken and discolored appearance and, in immature fruit, fails to color normally, leaving a green / yellow area' (Knight *et al*., 2002).

[40] Flavor is produced by combination of taste and aroma.

[41] (Sinclair, 1984) and (CBD, 2005)

1. Fruit size: Variety, rootstock, crop load, and irrigation practices affect fruit size. For example, when the crop is heavy or there are high numbers of fruit on the citrus tree, this will lead to a decrease of the average fruit size. Also good management of irrigation is very important to achieve good fruit set and to maximize fruit size.

2. Fruit shape: The choice of citrus fruit variety controls the fruit shape. Shape can also change when the fruit matures or the trees get older.

3. Peel quality: Skin thickness and peel quality are significantly influenced by variety choice, rootstock choice, nutrition and environmental conditions. For example the skin thickness of fruit which is grown on Rough lemon rootstock tends to be more coarsely textured with thicker skins than that grown on *P. trifoliate* rootstock. Plant nutrition, especially the balance of nitrogen, phosphorous and potassium affect peel characteristics meaningfully. For example when the levels of nitrogen and potassium in the fruit are excessive then the result will be a puffy fruit and with thick peel. Also the peel color development can be delayed due to excess of nitrogen.

4. Peel oil[42]: The amount of peel oil in fruit depends on variety and increases during the fruit develop and mature. Its yield can also be influenced by tree nutrition; for example when the nitrogen increases the oil yield will increase while it decreases when the potassium level is increased.

5. The pests, diseases, and wind can significantly reduce the external quality of fruit; therefore, it is very important to control pests and disease in addition to use the windbreaks in the citrus orchards.

2.4.2 Improvement of the citrus fruit quality

Citrus growers must produce high yields of high-quality citrus fruits economically to keep a feasible industry up. These objectives could be achieved by applying good management of nutrition, pruning, skirting, irrigation and drainage, pests and diseases control, and other

[42] The extraction of the peel oil citrus fruit like lemons and grapefruit is an important process in some countries; this oil is used in the industry (Naringin, which is extracted from grapefruit peel, gives tonic-water its distinctive bitter flavor. http://users.kymp.net/citruspages/grapefruit.html).

horticultural practices[43]. Thus, the success of citrus fruit cultivation in a region requires all of these practices to be optimized.

2.4.2.1 Nutrition and irrigation in the citrus farms

For better productivity and good fruit quality, citrus trees need sufficient quantities of mineral and compost nutrients, since the fruits are adapted to a wide range of soil types under variable climatic conditions. Remarkable decreases in the tree productivity and fruit quality are usually accompanied by the decline of nutrients. Irrigation, water quality, and water management are other important factors that impact good yield of high quality and longevity in citrus groves (Pradeepkumar *et al*., 2008; Ramsey, 2007; Byrne *et al*, 1998).

Availability of water throughout the year is very necessary for the optimal growing conditions of citrus fruit, where the requirement for water reaches the maximum peak during the warmer months in summer[44] (Falivene *et al*, 2006).

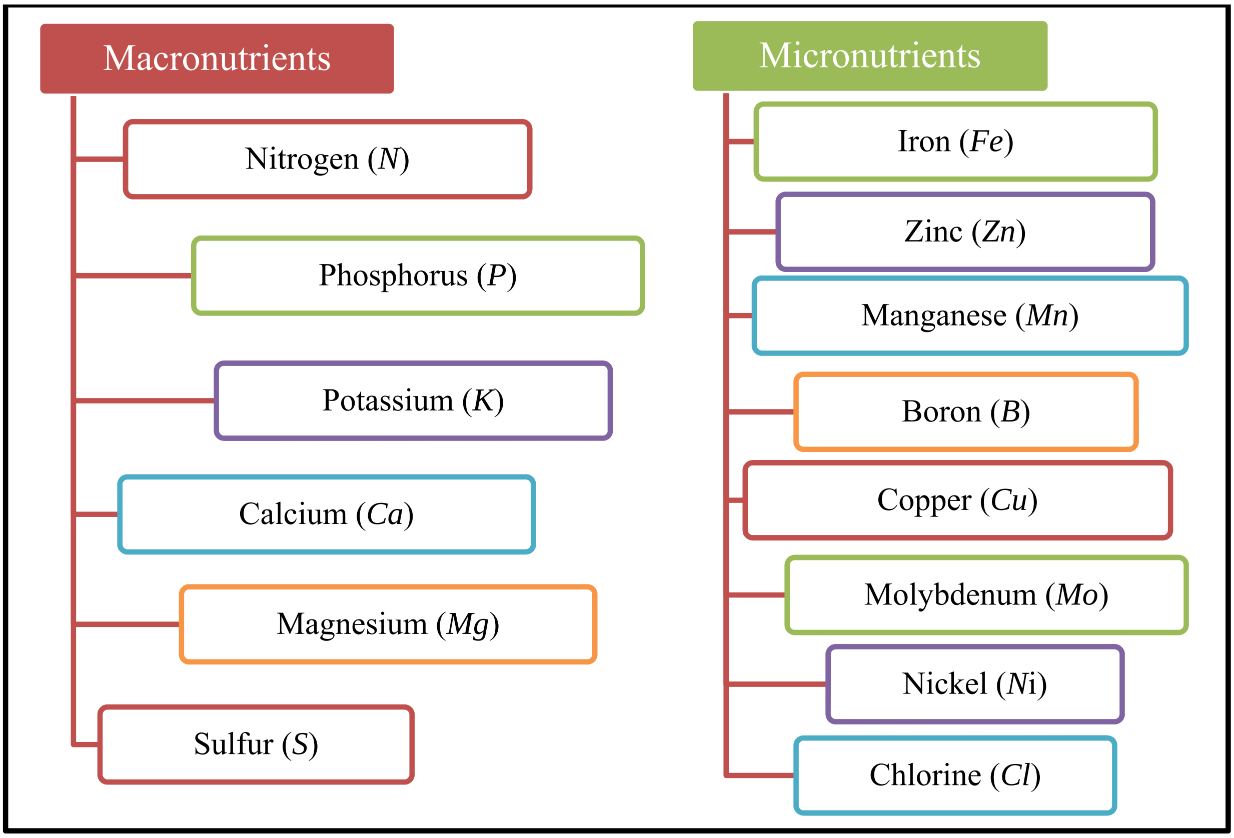
The nutrient management of citrus trees aims to minimize adverse effects on soil and water resources while maximizing financial returns to the grower. Fertilization is particularly important when the soil of citrus orchard is poor in available nutrients (Obreza, 2010).

Fruit juice content, soluble solids and acid concentrations, soluble solids/acid ratio, fruit size, and color are very important quality factors for citrus growers. Citrus growers usually distinguish between quality factors for the fresh and processing markets. For example, fruit size, shape, color, and maturity date are most important for fresh fruit; on the other hand, high juice content and soluble solids are necessary and desired for processed fruit. Therefore, the citrus growers have to understand nutrition and irrigation impacts on fruit quality, and to take into their consideration that irrigation is the most important factor of fertilizer program efficiency, in order to increase profitability, enhance sustainability, and improve worldwide competitiveness. Generally, citrus trees with adequate quantities of fertilizations and the use of effectual irrigation scheduling techniques grow stronger, tolerate pests and stresses better, yield more consistently, and produce high quality fruit; while, excessive nutrition and irrigation reduce the citrus fruit quality (Obreza *et al.* 2008).

[43] These techniques are very important to maintain high-quality fruits in addition to the factors that were referred to in the preceding paragraph (See 2.4.1)

[44] August is the warmest month in Syria.

Figure 11: Classification of mineral nutrients for citrus fruit



Source: own figure based on (Zekri et al., 2003)

Irrigation, Nitrogen (*N*), Phosphorus (*P*), Potassium (*K*), and some other micronutrients[45] like Boron (*B)* and Copper (*Cu)* are very important factors which are affecting the citrus fruit quality, (Figure 11).

Generally, fruit yield and fruit quality may be negatively affected when any nutrient element is seriously deficient. Trends in fruit quality response to N, P, K and Mg and water availability are described and summarized in the Table 11.

Table 12 explains more specific effects of macronutrients, micronutrients, and irrigation practices on internal and external citrus fruit quality.

The irrigation requirements of citrus trees vary due to climatic conditions, varieties, the effect of different growing areas on the water consumption, and the effect of the year time (Fares and Alva, 1999; CBD, 2005).

[45] These micronutrients impact only in the case of their deficiency in the soil.

Table 11: Trends in fruit quality response to increasing (*N*, *P*, *K* and *Mg*) and water availability

Nitrogen (*N*)	1. Increases juice volume and color, total soluble solids (TSS), and acid concentration. 2. Increases TSS/kg fruit and TSS/ha. However, excessive (*N*), particularly with inadequate irrigation, can result in lower yields with lower TSS/ha. 3. Decreases fruit size and weight. 4. Increases green fruit at harvest. High (*N*) may delay color break and increase re-greening of Valencia oranges. 5. Increases creasing and scab, but decreases peel blemishes like wind scar, mite russeting, and rind plugging. 6. Reduces stem-end rot and green mold of fruit in storage.
Phosphorus (*P*)	1. Reduces acid concentration, which increases TSS/acid ratio. 2. Increases number of green fruit. 3. Reduces peel thickness. 4. Increases expression of wind scar but reduces that of russeted fruit.
Potassium (*K*)	1. Decreases juice content, TSS, TSS/acid ratio, and juice color. 2. Increases acid content. 3. Increases fruit size, weight, green fruit and peel thickness. 4. Reduces splitting, creasing, and fruit plugging. 5. Reduces stem-end rot of fruit in storage.
Magnesium (*Mg*)	1. Slightly increases TSS/kg fruit and TSS/acid ratio. 2. Slightly increases fruit size and weight. 3. Decreases rind thickness.
Irrigation	1. Increases juice content and TSS/acid ratio. 2. Reduces TSS and acid concentration. 3. Increases fruit size and weight, and green fruit at harvest. 4. Decreases peel thickness. 5. Increases blemish from wind scar, scab and Alternaria brown spot (overhead irrigation only), but reduces rind plugging. 6. Reduces stem-end rot, but increases green mold of fruit in storage.

Source: own table depends on (Koo, 1988; Obreza et al., 2008; Obreza, 2010)

Usually, less rainfall means higher irrigation requirements (Romero *et al.*, 2008); however, considerable irrigation may be needed even in a highly wet year as a result of the poor rainfall distribution in subtropical climates[46] (Rogers and Bartholic, 1976). Mature citrus trees can use

[46] Suitable climates for citrus cultivation are the tropical and subtropical humid regions of the world. (i.e. Mediterranean climates), (Rieger, 2002)

between 900 and 3000 mm[47] of water per year depending on rainfall and irrigation management[48] (Manner *et al*., 2006).

Table 12: The effects of mineral nutrients, and Irrigation on citrus fruit quality[49]

Juice Quality	Macronutrients					Micronutrients					Irrigation
	N	*P*	*K*	*Ca*	*Mg*	*Mn*	*Zn*	*Cu*	*Fe*	*B*	
Juice Content	+	0	-	0	0	0	0	0	0	0	+
TSS	+	0	-	0	+	0	0	0	+	0	-
Acid (A)	+	-	+	0	0	0	0	0	0	0	-
TSS/A Ratio	-	+	-	0	+	0	0	0	0	0	+
Juice Color (red)	+	0	-	?	?	?	?	?	?	?	0
Juice Color (yellow)	+	0	-	?	?	?	?	?	?	?	+
Solids/box	+	0	-	0	+	0	0	0	+	0	-
Solids/acre	+	+	+	0	+	0	0	0	0	0	+
External Fruit Quality											
Size	-	0	+	0	+	0	0	0	0	0	+
Weight	-	0	+	0	+	0	0	0	0	0	+
Green Fruit	+	+	+	0	0	0	0	0	+	0	+
Peel Thickness	-[1]	-	+	0	-	0	0	0	0	0	-
Peel Blemishes											
Wind Scar	-	+	0	?	?	?	?	?	?	?	+
Russet	-	-	0	?	0	0	0	0	0	0	0
Creasing	+	0	-	?	?	?	?	?	?	?	0
Plugging	-	0	-	?	?	?	?	?	?	?	-
Scab	+	0	0	?	?	?	?	?	?	?	+
Storage Decay											
Stem-end Rot	-	0	-	?	?	?	?	?	?	?	-
Green Mold	-	0	0	?	?	?	?	?	?	?	+
Sour Rot	0	0	0	?	?	?	?	?	?	?	0

Increase (+) Decrease (-) No Change (0) No Information (?)
[1] Except in young trees where peel may be thicker

Source: (Obreza, 2010; Obreza *et al*., 2008; Koo, 1988)

In Syria, most of the produced citrus fruit depends on the irrigation system. Irrigated production constitutes 99% of the total produced citrus. The total cultivated area with citrus trees, which depends on irrigation, constitutes 99.9% of the total cultivated area with citrus

[47] Citrus consumption of irrigation water in Syria is about (9000 m3/ha), supplemented by similar volume of rainfall (CBD, Extension Program for Citrus Fruit Cultivation, 2005).

[48] Without irrigation, (900 mm) per year is typically needed for any significant fruit production.

[49] This table was a result of huge number of field experiments which were applied for many years to evaluate the response of oranges to irrigation and fertilization practices. Some of these effects appeared to depend on local conditions and cultivation regions, but in general, the observations were useful to develop a strategy to improve fruit quality for a special variety or location.

(AASA, 2010; CBD, 2010). Generally, citrus growers irrigate their orchards from different water resources[50]:

1. Artesian wells and water boreholes: These wells are drilled at the expense of farmers. In average, the fixed cost of drilling well, which its depth is (70-100 meters), is about 100000 to 150000 SP[51].

2. Dams: After 1963 the Syrian governments focused on the establishment of dams along the Syrian territories. The number of dams increased significantly after 1970. In 2006, the numbers of executed dams in Syria were 160, of them, 19 dams in the coast basin (Lattakia and Tartous provinces). These dams provide irrigation water basically for the fruit trees (mainly citrus orchards) and other irrigated crops which are cultivated in these two provinces like vegetable crops (the irrigated area was estimated by 51,745 Hectares in 2006)[52].

3. Rivers: There are four rivers in the coast basin (Al-Kabir-Al-Shamali, Al-kabir Al-Janubi, Banyas Costal, and Sinn)[53]. Farmers use pumps which are working by diesel or electricity to draw water from rivers to irrigate their orchards[54].

4. Public net irrigation technique: During the last 20 years, the majority of farmers switched to water supplied from public irrigation channels which draw irrigation water from dam reservoirs. Farmers used to pay a fixed rate for using water from these channels, this rate was 108 SP/Dunam in 1996, and then it has been raised to 250 SP/Dunam in 1999, 350 SP/Dunam in 2000 (Varela-Ortega and Sagardoy, 2001), and 500 SP/Dunam in 2006.

Farmers tend to use water from public irrigation systems instead of their private wells' water because there is no metering of usage. This leads to the excessive use of public irrigation

[50] Interviews with some citrus growers in Lattakia and Tartous provinces in 2006

[51] This cost includes: (70000 SP) for drilling, (30000 SP) for submersible borehole pump, (20000 SP) for pipes, valves and fittings, and (15000 SP) for water filters, control panel, cables, and sensors. (These prices were estimated approximately by farmers according to the market prices in 2006).

[52] Ministry of Irrigation in the Syrian Arab Republic. URL: http://www.irrigation.gov.sy/index.php?d=114.

[53] (CBS, 2010): Length of rivers within the Syrian land and their flow rates 2009.

[54] In May 2008, Syrian Minister of Economy and Trade issued a decision to raise the diesel prices from 7 SP/Liter to 25 SP/Liter., as a part of governmental plan to redistribute support. This abolition of governmental support for the prices of petroleum products led to increase of irrigation costs, consequently the cost of production increased. URL: http://www.syriasteps.com/index.php?d=136&id=20575.

water. This over-irrigation (especially in case of traditional open furrow irrigation method) in addition to water waste may wet the trunks of the trees and increase the incidence of root rot caused by *Phytophthora* (Graham and Timmer, 1994) and, therefore, the usage of chemical fungicides. The management and organization of irrigation water arrangement between farmers from public irrigation systems and reservoirs is difficult due to the wide variety of crops cultivated in this region.

Irrigation intervals[55] are determined by the age of the citrus orchard or tree size, soil type, daily water requirement[56], and the irrigation method. Farmers use three irrigation methods in Syrian citrus orchards:

1. Traditional open furrow irrigation
2. Sprinkler irrigation
3. Drip irrigation

In recent years, a lot of Syrian citrus growers turned gradually to replace the traditional open furrow irrigation method by sprinkler and drip irrigation methods. While sprinkler irrigation covers less irrigated area, the drip irrigation approximately halves water use, reduces weeds, fungal disease, and salinity; it also requires less labor and leads to better quality and juicier fruits.

Some farmers, whose their orchards are located near the sea, suffer from high salinity. Therefore, some of their older trees die due to waterlogging[57] which is caused by leakage of irrigation water and the poorly designed drainage systems. They indicated that they were unable to use public irrigation water for drip irrigation systems due to its high salt content.

Plant nutrition is a complex process involving many elements and interactions. With regard to citrus trees nutrition, successful fertilizer programs must include consideration of the important nutrients: nitrogen, phosphorus, potassium, calcium, magnesium, manganese, zinc, copper, iron, sodium, boron, and the chloride ion. These programs[58] are evolved over a number of years through careful monitoring of nutrient levels in the soil, plant tissue and

[55] See appendix 3 and appendix 4.

[56] Appendix 5: Irrigation schedule should start according to the soil moisture that can be determined by soil samples with auger or tension-meters (a moisture measurement tool). It directly measures the physical force that the root system must overcome in order to access water held in the soil (also known as matric potential).

[57] It refers to the saturation of soil with water. URL: http://en.wikipedia.org/wiki/Waterlogging_(agriculture).

[58] Appendix 6: Quantities of fertilizers should be added to the citrus tree (up to 10th year from planting).

assessment of yields and fruit quality. For example, the quantities of fundamental fertilizers (Nitrogen, Phosphorus, and Potassium) which should be added to the citrus trees in Syria are calculated according to the following fertilizer equation: (**$1N{:}1/4P{:}1/2K$**)

Fertilization constitutes a comparatively small proportion[59] of the total cost of citrus production, but it has a large effect on potential profitability. There are some important guidelines to use when making fertilizer rate and source decisions:

1. Visual evaluation of nutritional status.
2. Soil and plant analysis.
3. History of the field.
4. Production experience and economics.

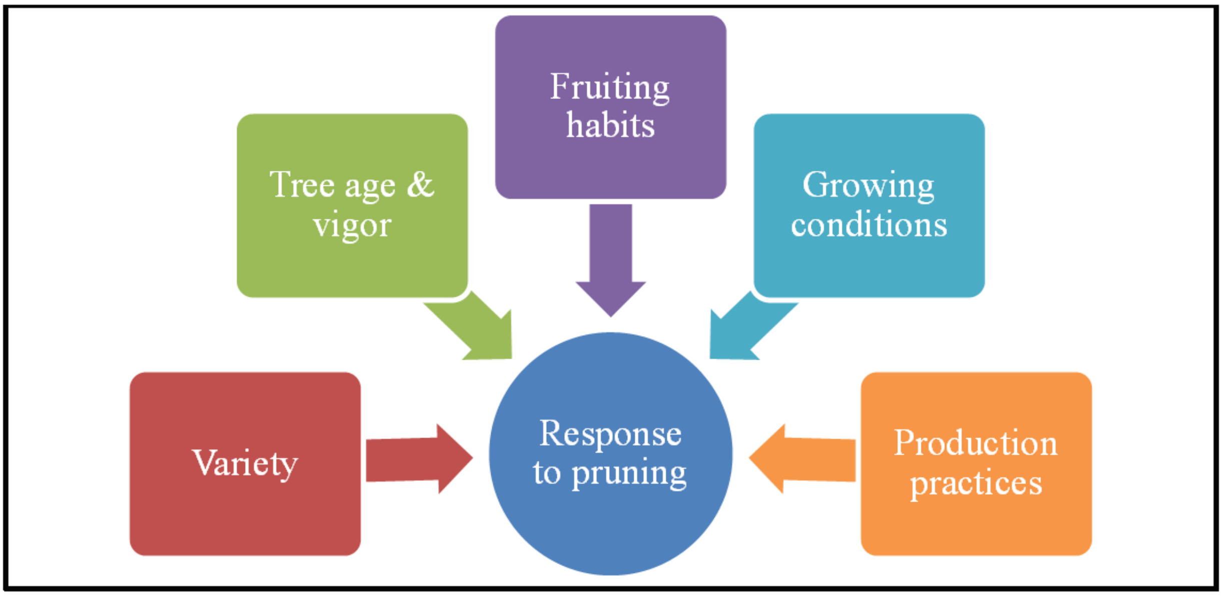
2.4.2.2 Citrus trees pruning

Pruning is a common horticultural practice leads to the best production of many fruit trees[60]. Generally, most types of deciduous trees are pruned to invigorate their growth, to improve the configuration of their branches, and hence to make these branches less likely to split under a heavy crop. Also, pruning improves fruit quality and reduces the crop load for better potential size of individual fruits. In the case of citrus trees which are perennial evergreen, usually less pruning is required in comparison with deciduous trees. However, they are in need to be pruned regularly for strong, well-balanced shape and optimal fruit quality and productivity. This is important during the initial years of tree growth, especially with the lemons and vigorous upright growing orange varieties. The response to pruning in citrus trees depends on various factors, (Figure 12).

[59] Up to 2006, the citrus growers in Syria were getting their orchards needs of fertilizers directly from the Agricultural Cooperative Bank (ACB) through cooperatives within their administrative units. The fertilizer prices were subsidized by Syrian government, for example: Nitrogen (6 SP/Kg), Phosphorus (9 SP/Kg), Potassium (12 SP/Kg), and compost (350-500 SP/m^3) according to its fermentation degree and cleanliness. In 2009, SMAAR raised the fertilizer prices, (See section 2.6).

[60] (Morales *et al*., 2002; Tucker *et al*., 1994; Kretchman and Krezdorn, 1961; Wright and Kelly, 2008; Fake, 2012; Dick, 2007; Pittaway, 2002; CBD, Extension Program for Citrus Fruit Cultivation, 2005)

Figure 12: Factors which determine the response of citrus trees to pruning



Source: Own figure based on (Tucker *et al*., 1994)

As growing habit, most of citrus cultivars are upright growing[61]. On the other hand, less trend to grow upright is seen in some of the limes, lemons, grapefruits etc. The terminal part of the upright branches has signed effect of dominance on its lower buds which fail to sprout and give laterals. As a result of bearing, these branches take horizontal form and then many of the second laterals would arise. One of these laterals, located near the terminal part of the main branch, takes upright position. In many cases, this portion grows as vigorous that the growth of the original branch is checked, and again would bow down on its sub-laterals. This cycle is proceeded as a result of this growth pattern. As a citrus tree advances in age, its lower part is filled up with weak and declining wood, therefore the under-cutting is required.

Pruning has variable effects on the internal and external fruit quality. Generally, the objective of citrus trees pruning is to manipulate various aspects of their vegetative and fruiting behavior which facilitate harvesting, like: tree form, shapes, and growth; flowering, fruit set, and crop load. There are also other reasons for citrus trees pruning:

1. Pruning allows the penetration of light into the tree canopy.
2. It prevents crowding of main scaffold branches and removes branches which cross.
3. It reduces tree height and width.
4. It reduces the biennial bearing[62].

[61] Branches are regarded as the most upright growing parts in the citrus trees.

[62] The biennial yield pattern is pronounced in the case of orange varieties more than the other citrus fruit types (See 2.3.2)

5. It removes or shortens water shoots to prevent them from becoming too dominant.
6. It removes dead, diseased, broken, weak or old branches.
7. It allows air circulation and access under trees (skirt pruning).
8. It increases fruit size and prevents fruit damage due to limb rubbing.
9. By pruning, citrus growers can rejuvenate old trees in their groves.

Tree rejuvenation aims to extend the economic production time of an orchard or to delay the time that replanting may become very important. The other advantages of this practice are:

1. It causes a general invigoration of shoot growth throughout the tree which will produce large, high quality fruit.
2. It reduces the height of the bearing surface, maintains a structurally sound tree, and eases spraying, harvesting and other grove operations.
3. It increases production and; reduces production costs.

Pruning ranks second after harvesting among the cultivation practices with impact on production costs of citrus fruits, due to its requirement of large amount of labor which adds a significant increase to the farm expenses. The main two ways are used for pruning citrus trees are the mechanical[63] and hand pruning. The labor cost of mechanical pruning is low in comparison with hand pruning which is labor intensive. However, it has been proven that this method results in unfavorable vegetative response on cut ends and in many cases causes dense regrowth, while hand pruning allows the pruner to have control of the type of cut to make.

In Syria, regular pruning for citrus trees can be made at any time[64], however, it is better to avoid pruning during the tree growing season, the preferable time is to do it during the winter, while the tree growth is dormant[65]. But it is also difficult to achieve that in the late maturing varieties such as (*Valencia*). In this case, it would be better to prune tree when the fruit size reaches 75% of their normal size.

Citrus pruning during late summer and early autumn is undesirable, as it causes late shoots growths which are more susceptible frost damage in the following winter and deplete large quantities of food, especially carbohydrates stored, without giving the perfect opportunity to contribute in storing carbohydrates again in the tree before the winter.

[63] In Syria, citrus growers are used hand pruning to prune their trees.

[64] Sprouts and small branches, removed by hand or with hand pruners.

[65] Between the ends of the fruits harvesting season and the beginning of the early growing and flowering season

Time of pruning may be determined by the presence of mature fruits on the trees. This causes some problems take place with 'Navel' oranges and winter-harvest grapefruit, when these crops are harvested before spring. In coastal areas, lemons are usually pruned after the last main summer harvest so that fewer nearly mature fruit are lost. It seems logical to prune immediately after a crop has been harvested as trees do not waste their energy producing non-marketable fruits which are removed by pruning before reaching maturity.

In general, pruning varies significantly in various citrus cultivars, but occurs after harvesting. Lemon is the only exception, as it is subjected to special pruning system because of its physiology and the growth dynamic of roots and shoots, in addition to the spread of mal secco disease (dry branches disease)[66]. Appendix 7 explains briefly the pruning of some of the important citrus species cultivated in Syria.

2.4.2.3 Citrus trees skirting

Tree skirting is a common practice in citrus orchards. It includes removing all lower hanging branches and foliage of the citrus tree canopy below the desired skirting height, normally about 60–90 cm (2-3 ft)[67]above the soil surface, preferably where they join the scaffolds, unless too much portions will be skirted. This practice can be done throughout the year, but not after final fruit set, because growing fruit may then be removed. The most practical time is after harvest or at the time of pruning[68].

Fruit quality damages by equipment, disease, insects and snails, lack of sunlight, herbicides, and excess moisture will often occur when limbs and fruits are in physical contact with the soil surface. Therefore, there are a lot of advantages of skirting for citrus fruit quality; since it prevents fruit and foliage from being in close proximity to the ground:

1. Skirting facilitates the movement of orchard equipment under the tree canopy and eliminates the mechanical damage to fruit[69].

[66] Mal secco of citrus is a highly destructive vascular disease of lemon, presently confined to the Mediterranean basin; it is caused by the mitosporic fungus *Phoma tracheiphila* and has a relevant economic impact on the lemon industry in this geographic region (Migheli *et al*., 2009)

[67] 1ft = 30.48 cm. See: URL: http://en.wikipedia.org/wiki/Foot_(unit).

[68] (El-Zeftawi, 1976; Wright *et al*., 2003; Burns *et al*., 1970; Morales and Davies, 2002; Phillips *et al*., 1990; Frost and Bailey, 1997; CBD, 2005)

[69] It prevents damage to fruit when equipment is used to spread fertilizers or mow inter-row sods.

2. It prevents fungal pathogens (e.g. *Phytophthora* spores) from being splashed onto the fruit and foliage from the soil[70].

3. It interrupts the pathway between weeds and citrus tree; thus, ants, snails, and other insects will not be able to reach to the tree[71].

4. When citrus growers skirt their trees, they will be able to apply broader coverage of herbicides and pest control materials easily without spray drift to fruit and foliage. This is important to reduce residues in fruit and the damage of herbicide to fruit and foliage.
5. It makes irrigation system more efficient by improving the uniformity of water distribution. Also the maintenance of irrigation systems will be much easier.

6. Skirting increases and improves aeration and air circulation inside the tree canopy. This leads to reduce incidence of disease and control them. It leads also to subsequent ease of inspection of tree trunks for gummosis and other disease, and help speeding the drying of fruit to be harvested.

7. Skirting reduces the percentage of fruit drop and increases the proportion of good quality fruit. That is because first fruit drop comes from the skirt and fruit remaining on the skirt is of lower quality than that carried on the higher parts of the citrus tree[72].

2.4.2.4 Windbreaks in citrus farms

Specific design criteria for field windbreaks depend on crop tolerance and risk factor[73]. According to their relative tolerance to physical and mechanical damages caused by wind and

[70] Skirting of lemon trees, for example, can reduce the percentage of fruit infected with *Phytophthora* brown rot (Burns *et al*., 1970).

[71] A lot of plant feeding, fungi feeding and predatory mites are oftentimes discovered in leaf litter and on weeds in citrus groves. Mites, which do not normally occur on citrus, may venture onto the fruit, If fruit and foliage are in touch with ground and weeds, even for short periods. For this reason and other agronomic reasons, proper combined weed control and skirting of citrus trees is recommended (Frost and Bailey, 1997).

[72] (El-Zeftawi, 1976) observed in the Mildura district, Victoria, Australia, that the value of skirting, which was especially applied on the late holding of 'Navel' oranges, had shown in its lack of effect on yield and quality and in its favorable initial reduction of pre-harvest fruit drop.

[73] All information in this section based on (Newins, 1937; Finch, 1988; CBD, 2005)

wind-blown soil, a number of widely grown crops were classified into four categories[74] of crops (Finch, 1988):

1. Tolerant crops: such as grain and forage crops.
2. Moderate tolerance crops: such as corn and sorghum crops.
3. Low tolerance crops: such as orchard and vineyard crops.
4. Very low tolerance crops: such as vegetable and specialty crops.

There is an inverse proportion between the tolerance level and the relative importance of shelter; this, in addition to the level of risk that the producer is willing to accept, determines the special design criteria of windbreaks. Due to this classification, citrus species are considered as low tolerance crops[75]. That means they are subjected to extensive damage because of the direct effects of the wind and wind related desiccation; therefore they need unique and specific wind protection design.

Regarding risk factor in the wind erosion guides, it is defined as the probability of crop damage that results from wind-blown soil in excess of the limits established for each tolerance category. However, in the wind damage guides, risk is defined as the probability of crop damage resulting from the direct effects of the wind (e.g. lodging)[76].

Because of their exposure, newly planted citrus trees are especially vulnerable to the wind damage which occurs, when foliage or fruit[77] is blown against thorns, branches or older leaves. Consequently, fruits develop characteristic ridge and irregularly shaped, raised areas on their surface, which enlarge and darken as the fruit matures. This blemish on the fruit surface is one of the major reasons for fruit being downgraded or rejected at the packing line. In general, a well-designed and maintained windbreaks system contributes significantly to the profitability of citrus orchard and to produce a marketable crop by reducing wind damage, and improves tree growth which affects the citrus grove productivity. As the essential purpose of windbreaks system is to filter and break the force of prevailing winds, however, that does not mean that it stop the winds completely (Hoffman *et al*., 2009).

[74] For more information about crops categories, see appendix 8.

[75] Young citrus orchards are classified in the very low tolerance category as they are even more susceptible to wind damage.

[76] Appendices 9, 10, 11, and 12 illustrate the risk factor of wind erosion and wind damage for each tolerance category.

[77] In citrus trees, the young foliage and fruits are particularly delicate.

The basic design of natural or artificial windbreak construction in citrus orchards determines the degree of protection offered which depends on the following criteria (Freeman, 1974; Finch, 1988; Newins, 1937; CBD, 2005):

1. Height and length of the windbreak trees: The higher the windbreak, the greater the protection zone. Generally, the protection provided by windbreaks is for a distance of up to 25 times their height. On the leeward side, the maximum protection zone is up to 12 times their height where wind speed is reduced by 75-50%. Some protection is also provided on the upwind side; this protection is up to 5 times their height. Ideally, the wind will not be able to deflect around the windbreak when its length is about 12 times its mature height. When shorter windbreaks are needed, growers select smaller sized trees.

2. Orientation of the windbreak: The maximum protection of citrus trees is achieved by positioning the windbreak at the right angles to the main winds for which protection is needed. Cold air drainage may be impeded when the windbreak is badly established; then the risk of frost will increase. Also gaps in the windbreak can cause localized wind turbulence.

3. Density of the windbreak: To reduce the wind velocities effectively, moderately dense windbreaks are needed because they do not cause as much downwind turbulence as dense windbreaks; their effectiveness is more over greater distances. Hence, it is better, where possible, to construct windbreak of 2-3 rows of trees and bushes of different heights. In case of single row windbreaks, if individual trees die and leave gaps or if trees lose their lower foliage as they mature, they may fail. The ideal width of the windbreak should not be more than 3 times their mature height.

4. Spacing of the windbreak: Geographic region, species, desired density and number of rows are the factors which determine spacing within and between rows. In Syrian citrus orchard, in case of single row windbreaks, spacing between seedlings within the row is about 50 cm. In the case of two rows windbreaks, spacing between rows is 100 cm, and within the row is 100 cm.

5. Species of the windbreaks: Wind protection of citrus orchard is achieved by growing different varieties and species of windbreak trees which vary due to its region. For example, the maximum length of the "protected zone" is achieved by selecting species which allow about 30-50% of the airflow though the windbreak. In Syrian citrus

groves, Casuarina[78] and Mediterranean Cypress[79] are the most popular species used as windbreak trees. They were chosen by citrus growers because of these features (Philp, 2006; CBD, 2005):

- They are evergreen, fast growing and reach their highest level in a short time of their cultivation in the orchard.
- Their roots can be controlled with a ripper.
- Rhizobia on roots are Nitrogen fixing[80], reducing the drain of nutrients from the soil.
- They do not self-seed easily.
- They can avoid leeward turbulence because they have reasonable wind permeability to create a good sheltering effect.
- They are tolerant of some degree of water stress and respond to side trimming.

Table 13 presents some advantages and disadvantages of windbreaks system which affect the citrus fruit quality and the conditions in citrus orchard.

Typically, windbreak trees should be cultivated minimum two years before the establishment of citrus orchard. They should also be fertilized and irrigated during the first few years to encourage growth, help them establish, and minimize the competition of them with the citrus trees. Windbreaks may need occasional hedging to reduce their shading effects[81] and to retain the ideal degree of permeability. Regular deep ripping of tree roots between the windbreak trees and the citrus orchard is essential too. In areas of low rainfall permanent irrigation may be necessary (Newins, 1937).

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[78] ***Casuarina Species*:** Casuarina is a genus of 17 species in the family Casuarinaceae, native to Australasia, Southeast Asia, and islands of the western Pacific Ocean. For more information please see: URL: http://en.wikipedia.org/wiki/Casuarina.

[79] ***Cupressus sempervirens*:** Also known as Italian, Tuscan, or Graveyard Cypress, or Pencil Pine) is a species of cypress native to the Eastern Mediterranean region, in Western Syria, Lebanon, Cyprus, Southeast Greece (Crete, Rhodes), Southern Turkey, Northern Egypt, Northeast Libya, and other countries in the Middle East. For more information please see: URL: http://en.wikipedia.org/wiki/Cupressus_sempervirens.

[80] Nitrogen fixation is the natural process, either biological or abiotic, by which nitrogen (N_2) in the atmosphere is converted into ammonia (NH_3). This process is essential for life because fixed nitrogen is required to biosynthesize the basic building blocks of life, e.g., nucleotides for DNA and RNA and amino acids. For more information please see: URL: http://en.wikipedia.org/wiki/Nitrogen_fixation.

[81] The shade caused by windbreaks can have a prejudicial effect on neighboring citrus orchard trees.

Table 13: Advantages and disadvantages of windbreaks system to the citrus orchards

Advantages of well-designed windbreaks:	Disadvantages of not properly managed windbreaks:
1. Reduced physical damage to fruit and trees like wind scarring of fruit.	1. The competition for moisture and nutrients will increase in the orchard.
2. Reduced wind speed.	2. Causes shading.
3. Increased and earlier crop yields.	3. Trees may harbor pests.
4. Reduced soil erosion.	4. May act as a heat trap in summer.
5. Reduced dust on plants, thereby increasing photosynthesis and reducing the damage caused by scale insects and mites.	5. Increased humidity which can slow drying times of foliage and fruit and may privilege some fungal pathogens.
6. Reduced wind borne diseases.	6. Increases material and labor costs.
7. Slightly higher daytime temperatures in winter (up to 3° C).	7. If poorly designed, it may increase turbulence.
8. Slightly higher humidity (that lead to reduce frost).	8. May compete with trees for light and valuable water.
9. Provides a habitat for insect predators and pollinators.	9. Possible pest and disease buildup in a crop due to microclimate[82] changes.
10. Reduced spray drift and improved spray coverage.	10. Interferes with the movement of machinery.
11. Reduced up to 30% of water loss from evaporation.	11. In frost prone areas may dam cold or frosty air if not designed properly.
12. Provides protection from sun for harvested bins of fruit and for workers.	12. Tree seeds and flowers may attract unwanted bird species.

Source: Own table based on (Kort, 1988; Norton, 1988; Dewdney and Graham, 2012).

2.4.2.5 Trees spacing and high density planting in the citrus farms

High density planting (HDP) in fruit cultivation was first founded in apple in Europe in the early sixties of the last century as one of the important methods to achieve high productivity per unit area. The worldwide tendency to adopt HDP in horticultural crops (including citrus), especially by growers with small landholdings, increased continuously as a result of (Tucker, *et al.*, 1994; Chadha and Choudhary, 2007):

[82] Microclimate is a small, local region having a unique pattern of weather or weather effects. For example: The microclimate on the south side of a building may differ from the one on the north, so that different plants may thrive. Another example: The coastal hills are home to many different microclimates, while macroclimate is the climate of a relatively large geographic area.

1. Constraints on growers of tree crops due to decline in the availability of cultivable land and water.
2. Rising energy and land costs together with the mounting demand for horticultural produce.
3. More stringent land use regulations.
4. The desire for earlier economic return on investment and a need for increased management efficiency.

With regard to citrus cultivation, there are permanent discussions throughout producing regions of the world about the optimum spacing of trees in order to produce yields of high quality fruit for maximizing net returns. Decisions on HDP in citrus crops are made according to six important components (Tucker and Wheaton, 1978)[83]:

1. Vigor of tree[84] (particular scion/rootstock combination).
2. Climate (as it relates to vigor of growth).
3. Soil fertility and drainage.
4. Water availability.
5. Use of chemicals and suitable crop management practices[85].
6. Market outlet-fresh or processed.

Due to their study, Tucker and Wheaton (1978) found that wider spacing gives greater production later on in the life of the grove, while spacing with larger numbers of trees per unit area results in greater early production.

Whitney and Wheaton (1984) resulted from their experiments about the effect of three different citrus trees spacing on fruit distribution[86] and yield, that:

1. a greater percentage of fruit was occurred in the upper parts of the tree at closer spacing;
2. more inside fruit were found on trees at wider spacing;
3. higher yields were obtained from trees at closer spacing.

[83] (Lombard, 1950) noted this quote: "As most of us live for very few 20-year periods, the average grove should be planted on a somewhat crowded basis".

[84] The closer the spacing and the more vigorous the trees, (Tucker, et al., 1994)

[85] Best Management Practices (BMPs).

[86] Fruit distribution on the tree is important from the harvesting standpoint.

The influence of trees spacing on tree size, yield, fruit quality, and economic return; varies due to the citrus species. However, there are some common effects according to the results of experiments carried out by Wheaton *et al.* (1990), Wheaton *et al*. (1995), and Whitney *et al*. (1991):

1. Yield increases with increasing trees density during the early years of a planting.
2. Yield is independent of density at tree maturity.
3. Rootstock vigor is an important factor in higher density plantings.
4. Citrus trees are flexible and adapt to a range of space allocations, due to the fundamental importance of their vigor in determining the trees spacing and density in new citrus orchards.
5. Trees spacing has minor effects on fruit quality.
6. Higher density plantings provide better-financial returns.

In general, high density planting is important for citrus cultivation as it permits (Phillips, 1978; Wheaton *et al*., 1995; Parsons and Wheaton, 2009)[87]:

1. Efficient use of land and resources.
2. Higher yield and net economic returns per unit area.
3. Easy canopy management and mechanized field operations.
4. Efficient weed and diseases control.
5. Improvement in fruit quality.
6. Easy and efficient harvest.

In accordance with the number of trees planted per hectare in a fruit orchard, (Chadha and Choudhary (2007) classified HDP into three systems:

1. Semi-intensive system: It accommodates 500 – 1,000 trees per hectare.
2. Intensive system: This one accommodates 1,000 – 20,000 trees per hectare.
3. Super-intensive system with 20,000 – 100,000 trees per hectare.

Among the various citrus types, grapefruit trees are usually larger than orange trees which are larger than most specialty types. Therefore trees spacing in orange orchards should be wider for grapefruit and lemons (Jackson, 1995; Zaman, 2005).

[87] See appendix 13.

In Syria[88], before planting citrus seedlings in the permanent ground, an outline for the entire area to be cultivated is placed, indicating: fields' places, windbreaks, the main and secondary roads, and places of warehouses and buildings[89].

Citrus fruits are cultivated in different ways, including, rectangular, square and triangular etc. The best one of these methods is the rectangular, as it allows growers to use agricultural machinery optimally in order to carry out different services (plowing, control, harvesting, fertilization etc.). Furthermore, it allows increasing the number of trees per unit area and thereby production will increase until a certain trees' age[90].

In the rectangular method, the distance between the seedling and the other differs from the distance between one row and the other. Generally, experts recommend citrus growers to plant citrus seedling according to the following trees spacing[91]:

1. In the rectangular method: 3 × 4 m in the small agricultural holdings, while in the large holdings growers may use 4 × 6 m. 4 m is the space between seedling and the other one in the same row (towards west-east[92]), and 6 m is the space between row and the other one (towards south-north[93]).

2. In the square method: 4 × 4 m or 5 × 5 m, in the small agricultural holdings; while in the large holdings, growers may use 6 × 6 m or 7 × 7 m trees spacing.

According to the previous trees spacing, citrus growers have to remove one row whenever the trees are progressing in age, in order to prevent them from overlapping with each other, especially in the small agricultural holdings.

As example, Table 14 shows trees spacing after removing rows in the rectangular and square methods.

[88] Interviews with some citrus growers and experts in Lattakia and Tartuos, August 2006

[89] Growers have to take into account that the area of these facilities should not be exceeded more than 10-15% of the total grove area, because increasing this area more than this limit will reduce the number of citrus trees per unit area and thus production will reduce.

[90] This certain age ranges between 15 and 20 years.

[91] The distance between first row of citrus trees and the windbreaks should be 5 m at least.

[92] To protect citrus trees from damages caused by the Southwest wind that prevails the winter over citrus-growing region.

[93] This direction provides adequate sun light for all trees planted on the same row and prevents them from shading each other.

Table 14: Illustrates trees spacing in a citrus orchard at different tree ages

	Trees spacing at the seedlings cultivation	Trees spacing after 10 years	Trees spacing after 15 – 20 years
Rectangular	3 × 4 m	6 × 4 m	6 × 8 m
Square	4 × 4 m	4 × 8 m	8 × 8 m

Source: own table based on interviews with citrus experts and growers in Syria, August 2006.

The spacing of mandarin and orange trees is normally 5 x 5 m, giving some 350-450 trees per hectare[94]. Some lemon varieties can be spaced more closely, down to 3x4 meters. The varying trees spacing, which are used by Syrian growers, improve resource efficiency and optimize citrus fruit production for maximum economic return.

2.5 The concept of Integrated Pest Management (IPM)

IPM has a lot of conceptual definitions which were developed by scientists during the 1960s. Most of these definitions indicate that the main goal of the IPM is to prevent pests from reaching the economically damaging levels by using natural or ecologically sound principles or techniques, and using multiple tactics, including cultural, biological, and chemical (Fernandez-Cornejo and Jans, 1999).

Kogan (1998) synthesized a definition of IPM based on an analysis of compendiums of nearly 70 definitions spanning the past 35 years: "*IPM is a decision support system for the selection and use of pest control tactics, singly or harmoniously coordinated into a management strategy*[95]*, based on cost/benefit analyses that take into account the interests of and impacts on producers, society, and the environment.*"

Based on Kogan's definition, Prokopy (2003) summarized the concept of IPM as: "*A decision-based process involving coordinated use of multiple tactics for optimizing the control of all classes of pests (insects, pathogens, weeds, vertebrates) in an ecologically and*

[94] In Syria, citrus orchards with a 1.000 trees per hectare or more can be classified as high-density spacing. When trees number is less than 1.000 trees per hectare, then the orchard is classified as conventional spacing.

[95] Strategy is overall plan to reduce a pest problem, while tactic is the actual method used to implement the strategy (Alston, 2011). For more information about the general IPM strategies and Pest Management methods, visit the following websites:

1. IPM of University of Connecticut. URL: http://www.hort.uconn.edu/ipm/general/htms/ipmstrat.htm.
2. National IPM network of North Dakota State University.
   URL: http://www.ag.ndsu.nodak.edu/aginfo/ndipm/strategiesipm.htm.

economically sound manner." This definition implies for the IPM practitioner the following perspectives (Ehler, 2006):

1. Management of multiple pests simultaneously.
2. Monitoring of pests and their natural enemies and antagonists regularly.
3. Use of economic or treatment thresholds when applying pesticides.
4. Integrated use of multiple, suppressive tactics.

The most important objectives of an IPM program among the different economic agents[96] are (Alston, 2011; Ehler, 2006; Fernandez-Cornejo and Jans, 1999):

1. Optimize profitability over the long run for all economic agents.
2. Sustain agricultural and natural resources over the long term.
3. Rational use of pesticides.
4. Reduce environmental[97] contamination and costs.
5. Conserve and augment the use of natural biological controls.
6. Utilize selective pesticides and a proper timing of applications.
7. Minimize pesticide resistance problems.
8. Minimize pest resurgence and secondary pest outbreaks[98].
9. Improved food safety by reducing residues of pesticides on food products.
10. Higher worker safety which depends on safe pest management tactics.

Scientists characterized the typical steps[99] of an IPM program into three integration levels. While the first one focused on monitoring and managing a single species or species complex, the second level considered how practices impact multiple pests and concentrated on complementary, biologically based management options. Multi-crop, multi-season, and multi-tactic considerations, in the third level, were well integrated into the decision-making process, (Flint and Gouveia, 2001).

[96] Like: Farmers, agricultural suppliers, and consultants.

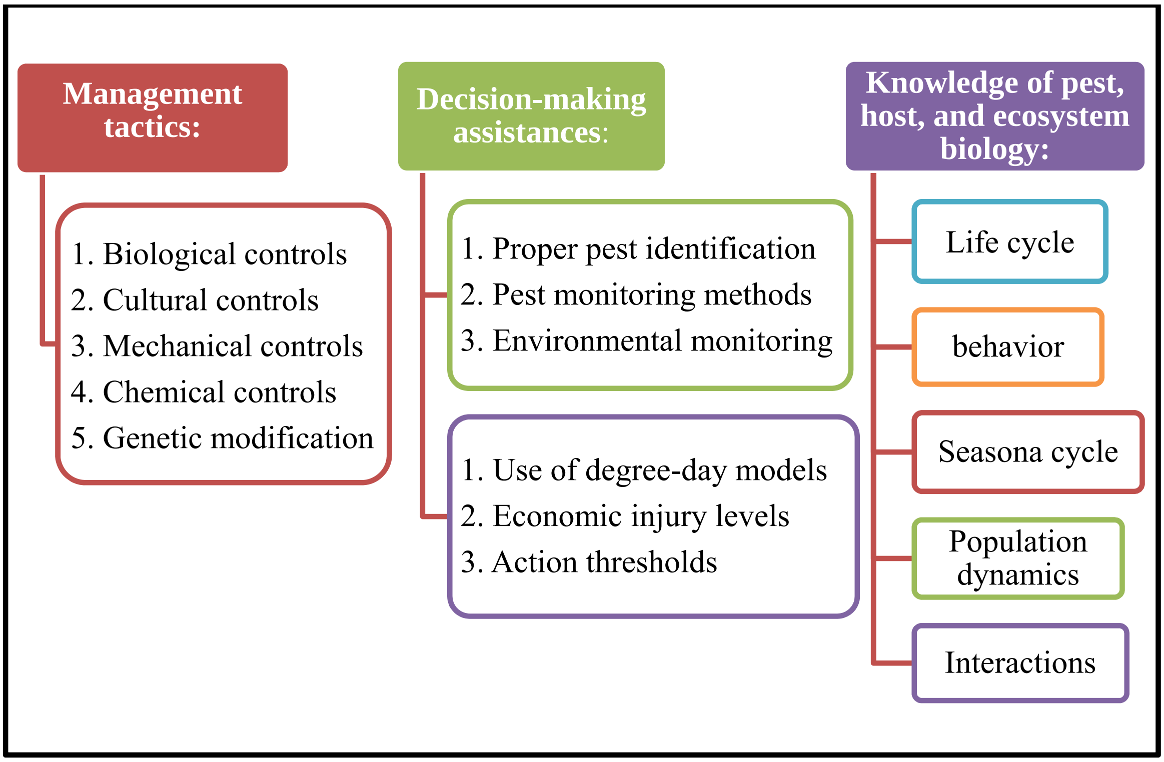
[97] In: Soil, ground water, surface water, pollinators, wildlife, and endangered species.

[98] Often they are caused by elimination of natural enemies with pesticides.

[99] More information is available in the website of South Dakota State University. URL: http://www.sdstate.edu/ps/extension/ipm/steps.cfm.

Figure 13 presents building blocks of information that allow citrus farmers to make good pest management decisions[100].

Figure 13: Schematic IPM concept



Source: Own figure based on (Alston, 2011)

This figure divides the IPM program of citrus into five main items (Broughton, 2006):

1. Identification the major insect pests, predators, and parasites that are present in the citrus orchard, their phenology[101] and their distribution within region. To achieve this stage, surveys of orchards over groves area are done.

2. Monitoring pests accurately by growers. In this stage, workshops for citrus growers, the provision of IPM information, and farm notes are the most important materials approved.

3. Decision making which is based on economic injury levels (action threshold levels). These levels are pre-calculated by researchers on the citrus grower properties.

[100] These informed decisions are dependent on knowledge of pest, host, and ecosystem biology.

[101] when they are present and active in the citrus orchard

4. Selection and testing of control options, whether these options were preventative[102] or remedial[103], including commercially available bio-control agents and an IPM compatible insecticide.

5. Application of the control options and evaluation of the effectiveness of results which leads to feedback that helps farmers' decision-making.

According to Hann *et al*. (2008) and Dively (2010), there is a relationship[104] between the economic injury level, economic threshold, action threshold, and general equilibrium position of a pest population.

Mediterranean European countries are becoming more widely dependent on the principles of integrated pest management in citrus fruit cultivation. Although the EU has very strict regulation rules in choice of the appropriate IPM strategy, the risk of heavy pollution of the environment is a big concern of consumers, nevertheless (De Nino *et al*., 2003).

The Citrus Board in Syria has been progressively introducing the IPM strategies, since it successfully controlled an outbreak of Wooly Whitefly[105] (*Aleurothrixus floccosus*) within citrus groves in 1992 by using a parasite called *Cales noackie*. This first use of biological control widely opened the door to apply their programs[106] by citrus farmers as it is one of the most important options of the implementation of IPM[107].

2.5.1 The concept of biological pest control

Biological control is an important component of integrated pest management (IPM) programs (Weeden *et al*., 2007). It has, as a concept, a lot of definitions. Flint *et al.* (1999) defined biological control as: "*Any activity of one species that reduces the adverse effects of other species*."

[102] Preventative options: Biological control, physical control, cultural control, and genetic modification.

[103] Remedial options: Options used to restore pest populations to below economically damaging levels such as pesticides and augmentative biological control.

[104] More information about this relationship is available in the appendices: 13, 14, 15, and 16.

[105] This small insect became one of the most serious challenges in Syrian citrus orchards which caused significant economic losses, because its control is difficult and complex as it rapidly gain resistance to the chemical pesticides.

[106] These programs were developed by the agricultural experts of SMAAR and scientists of Syrian agricultural faculties.

[107] Interviews with some Syrian citrus growers and experts of citrus board, 2007

Another definition of biological control was introduced by Eilenberg *et al*. (2001) as: "*The use of living organisms to suppress the population density or impact of a specific pest organism, making it less abundant or less damaging than it would otherwise be.*"

Due to the last definition of biological control, it is very important to distinguish it from natural control[108] and from similar methods of pest control which do not involve whole living organisms (Rebek *et al*., 2012).

Biological control is a part of wider phenomenon of natural control (Alston, 2011). Natural control was defined by (De Bach and Rosen, 1991) as: "*The regulation of populations within certain more or less regular upper and lower limits over periods of time by any one or any combination of natural factors.*" These natural factors were calcified by De Bach and Rosen into two groups; biotic (living potential of the species) and abiotic (non-living or environmental resistance). Generally, the most considerable factors in natural control are:

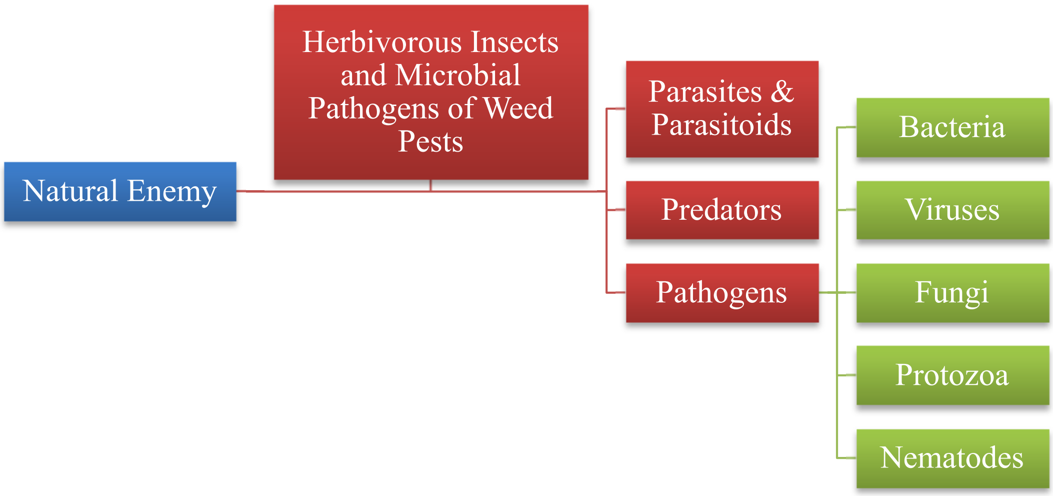
1. Natural enemies (parasites, predators, and pathogens).
2. Weather and other physical factors.
3. Food (quality and quantity).
4. Interspecific competition (other than natural enemies).
5. Intraspecific competition.
6. Spatial or territorial requirements.

In the simplest terminology, biological control aims to reduce the populations of harmful pests through the actions of other living organisms which are often collectively referred to as natural enemies (Smith and Capinera, 2000; Michaud *et al*., 2008). Figure 14 classifies the agents (natural enemies) of biological control.

In the recent years, biological control has become a key component of crop protection worldwide and the interest in the application of their programs has increased considerably. This has been coupled with the development of appropriate strategies for the use of biological control agents in very different ways to suite different needs (Waage, 2001). These strategies can be grouped into four major categories (Eilenberg *et al*., 2001; Hajek, 2004). Figure 15 illustrates the definitions of these four different control strategies.

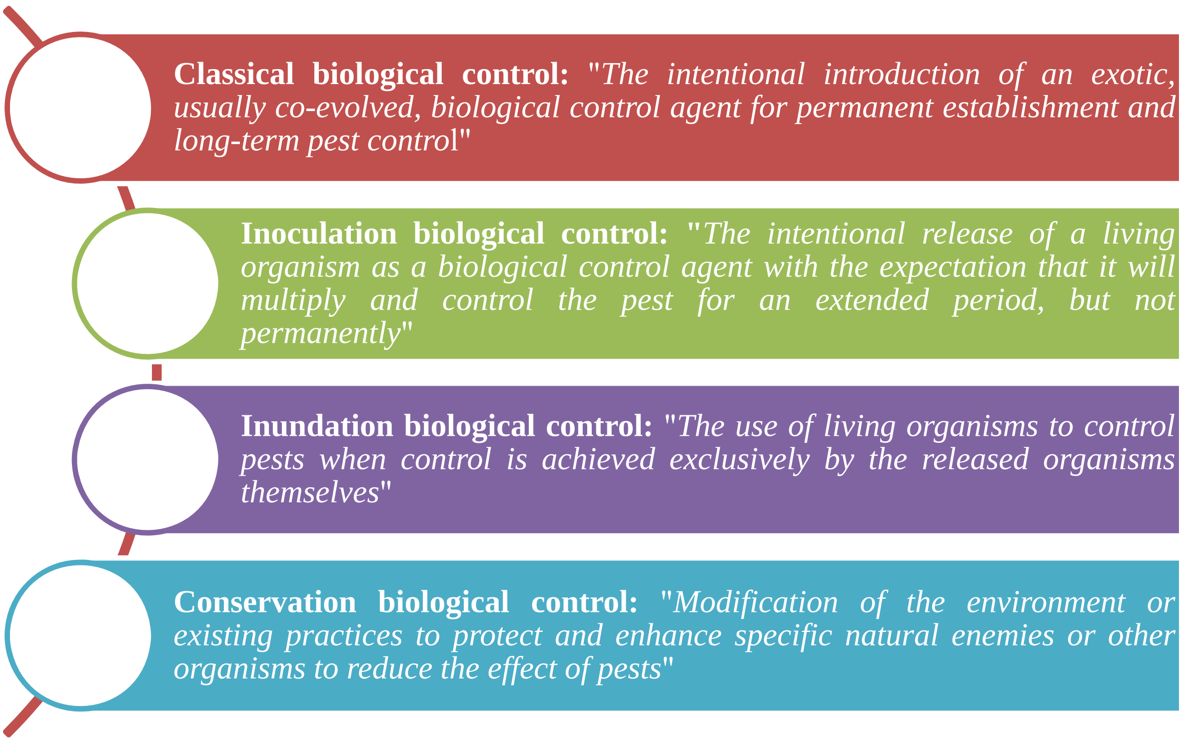
[108] Natural control does not require human intervention.

Figure 14: Classification of the natural enemies of biological control



Source: Own figure based on (De Bach and Rosen, 1991; Bellows *et al*., 1992; Alston, 2011).

Figure 15: The principal biological control strategies



Source: Own figure based on (Eilenberg et al., 2001; Hajek, 2004).

Generally, there are a lot of effects of applying biological control programs in fruit orchards. These effects are classified into two groups according to the type of their impact on the cultivation of fruit trees (Khachatourians, 1986; Altieri *et al*., 1997; Aliniazee, 1996):

1. The economic and environmental impact is:

    - reduced pesticide costs;

- reduced application costs;
- reduced crop damage;
- increased fruit exports;
- reduced pesticide resistance;
- reduced environmental contamination and residues of fruit;
- and promulgate sustainable agriculture and organic farming.

2. The social and political impact:

   - It is hard to measure the social and political impact of biological control programs.
   - Recent publicity about toxic residues on food products has enhanced both the public's and growers' appreciation of biological control.
   - The interest of politicians in alternative pest controls, including IPM and biological control increases. Furthermore, they emphasize their support for such programs.
   - Therefore, there has been some increase in funding for research on alternative technologies and a stricter enforcement of restrictions on pesticides use.
   - Growers, who adopt biological control programs, can reduce the cost of production, eliminate some pesticide sprays, and enjoy a higher income.
   - Consumers welcome the news of reduced pesticide use.
   - A small proportion of the pesticide industry might experience a decline in income.
   - The publicity and enthusiasm surrounding biological control can lead to an oversimplification of the technology and result in unreasonable expectations.

2.5.2 The program of biological pest control in Syria

Biological control agents are treated on a par with commercial pesticides or fungicides for the purpose of registration in many countries as well as the European Union. In developing countries, where the costs of chemical treatments can be prohibitive, their programs remain a very vital disease-management strategy (Gnanamanickam *et al*., 2002).

Citrus orchards are affected by large and diverse assemblages of insect pests. However, the many species of these pests have effective parasitoids which are now widely applied. Where this is done the pesticide-induced problems have abated (Greathead and Waage, 1983).

Pesticides mishandling and their unplanned, indiscriminate and over use affects environment, health, and socio-economic conditions of the community and leads to many other problems (Chiras, 2010; Khan *et al*., 2010; Shetty, 2004):

1. Pesticide residues in agro ecosystem.
2. Development of insect resistance to pesticides and resurgence of target pests.
3. Outbreak of secondary pests and emergence of new strains.
4. Destruction of pests' natural enemies.
5. Environmental pollution (soil, water, air).
6. Accumulation of pesticide in food chain.
7. Health related issues[109] such as human and domestic animal poisoning.
8. Increased damage of wild life and loss of biodiversity.
9. Lavish and misuse of pesticides leads to enormous economic losses, environmental pollution, and increases the cost of production, while pest problem still persist.

Due to the previous effects of chemical pesticides' misuse the biological control methods have been adopted in many countries of the world in order to maintain the integrity of the environment and public health and to restore the ecological balance. Syria Arab Republic was one of these countries through Citrus Board Directorate[110].

Citrus board started the first step in this way in 1992 when it controlled, quite successfully, the Wooly Whitefly. Subsequently, the citrus board adopted biological control programs[111] for red, soft, and wax scale, mealy bugs, citrus leaf miner, and mites, in addition to white fly, Mediterranean fruit fly, citrus flower moth, and aphids.

[109] Signs of several serious human aliments may be caused by the indiscriminate use of chemical pesticides such as: hypertension, liver diseases, and the most common being cancer. It is estimated that annually thousands of the farmers and farm workers are poisoned due to pesticide exposure (Khan *et al*., 2010).

[110] See section 2.3.1.

[111] See appendix 18 which shows the biological control program of citrus pests in Syria.

Implementation of the IPM programs, including the integrated biological control, by Syrian citrus growers has been considerably successful due to the following advantages which have been achieved during the last twenty years[112]:

1. It has led to a significant increase in citrus production[113].
2. It has led to a substantial and marked increase in areas planted with citrus[114].
3. It avoids environmental pollution.
4. It has the potential for significantly cutting production costs by reducing the need for insecticides.
5. According to citrus boards' reports between 1990 and 2005, the Syrian citrus crop can be considered free of the impact of residual pesticides[115] since the mid-nineties of the last century[116].

Chemical fungicides and herbicides are still used by limited and individual citrus growers[117], especially within larger farms. But 95% of Syrian citrus production may be deemed as organic as a result of precise application of IPM and Best Management Practices (BMPs) programs by farmers in cooperation with experts of the citrus board and extension units which are distributed in the citrus cultivation regions[118].

Another advantage of the application of these programs by Syrian growers is the ultimate elimination of Citrus Tristeza Virus (CTV)[119] despite its presence in some nearby countries including Cyprus. An outbreak of CTV in Syria could devastate the citrus produce since it

[112] Interviews with some Syrian citrus growers and experts of citrus board and AEU in the years: 2005, 2006, and 2007); (CBD, 2005).

[113] See sections 2.3.3 & 2.3.4

[114] See section 2.3.1

[115] Residual pesticides: "*A pesticide remaining in the environment for a fairly long time, continuing to be effective for days, weeks, and months*" URL: http://www.eionet.europa.eu/gemet/concept?cp=6146.

[116] See appendix 19.

[117] Such farmers reported that biological control is not always effective and must be supplemented with chemical insecticides.

[118] The existence of these programs is likely to be of major importance in the marketing of Syrian citrus fruit especially in foreign markets like EU markets. See appendix 20.

[119] It is a very serious virus, injures citrus trees, and exists in most producing countries. It has a lot of symptoms like: trees stunting, leaf chlorosis, and fruit size reducing. CTV is transmitted by budding and by aphid vectors. It is controlled either directly by: pruning or removal of infested trees, or indirectly by: avoid sour orange rootstock, CTV-free bud-wood programs, or control vectors like *Toxoptera citrisidus* (Bar-Joseph *et al*., 2002; Fifaei *et al*., 2007; Papayiannis *et al*., 2007; Djelouah *et al.,* 2009).

kills trees. The citrus board plans to test whether Syrian sour orange rootstock is CTV resistant since it has been proved that sour orange is susceptible to CTV in other countries. The necessity of this work has priority for the citrus board in order to be able to develop suitable alternative rootstocks that can resist this virus.

2.6 Production inputs supply of citrus fruit

Citrus seedlings, chemical fertilizers, and natural enemies of the agricultural pests are considered the most important inputs of the citrus production in Syria[120]

The Syrian Ministry of Agriculture produces citrus seedlings within its nurseries which are operated by the citrus board[121] and agricultural directorates in Lattakia and Tartous. Table 15 shows the annual plan[122] of produced citrus seedlings. There are a number of private nurseries which produce citrus seedlings as well. Most of their production is sold to use as ornamental plants in gardens. They often export their produced seedlings to Lebanon.

Table 15: Annual plan of produced citrus seedlings within governmental nurseries in the provinces of Lattakia and Tartous

	Lattakia			Tartous		SUM
Agricultural nursery	Al-Hannadi	Fedio	Al Sinn	Tartous	Amrit	
Number of produced seedlings	400,000			200,000		600,000
%	66.67%			33.33%		100%

Source: own table based on (CBD, 2007)[123].

[120] Interviews with some Syrian citrus growers and experts of citrus board and AEU in the years: 2005, 2006, and 2007.

[121] Syria government banned the importation of citrus seedlings in 1987 as a response to the desire of the Agricultural Ministry and the citrus board which is responsible for citrus seedlings produce. The citrus board has used thirteen different rootstocks in the production of citrus seedlings. Sour orange was the most important rootstock on which other varieties are grafted. Recently, the citrus board has selected a group of root stocks and incorporated them into the seedlings production plan.

[122] This plan is put annually by the citrus board in cooperation with agricultural directorates in Lattakia and Tartous provinces. The numbers which are contained in the plan are approximate numbers.

[123] This table based on data cited in some articles published on the web site of Syrian Agricultural Ministry in Arabic, 2012 and 2009 respectively:

URL: http://moaar.gov.sy/main/archives/1981.

Non-cooperative farmers annually subscribe to citrus seedlings in all Agricultural Extension Units[124] according to administrative and technical instructions issued by the Ministry of Agriculture. The subscription should take into account the following matters:

1. The nature of cultivated region, its climate, soil quality, and its suitability with the type of citrus to be grown.
2. One dunam needs 30-35 citrus seedlings.
3. The instructions should allow farmers to subscribe to a number of citrus seedlings more than their orchards need in order to carry out the process of patching and replacement of aging or diseased or low-rent economic trees.

Farmers' applications are compiled within nominal lists in the agricultural interests and then sent to the citrus departments in the directorates of agriculture. After that, sales coupons are equipped[125]. By these coupons, farmers receive the requested seedlings directly from the nursery according to their precedence by the date of subscription.

The cooperative farmers subscribe to seedlings through cooperatives in coordination with extension units. Each farmer is allocated with a specific number of seedlings at a specific time.

In general, the distributed seedlings must meet the following specifications:

1. Their origin and variety are reliable.
2. Their shoot system is good and their leaves do not suffer from a lack of nutrients.
3. They are intact of insect, fungal, and bacterial infections and their roots are healthy.
4. They are planted in grow bags of good vital and these bags[126] should be free of weeds.
5. Their length is at least 60 cm and they are free of seed shoots.
6. The rootstock is cut above the grafting area and the scion is full and well accreted.

Table 16 shows the prices of citrus seedlings in the governmental and private nurseries between 2003 and 2009. It is clear that the seedlings prices of private nurseries are much higher than governmental nurseries. Ministry of Agriculture had reduced the price of citrus seedlings in their nurseries in 2009 by half in comparison with the previous year.

URL: http://www.baladnaonline.net/ar/index.php?option=com_content&task=view&id=37083&Itemid=75.

[124] AEUs which exist in the citrus-cultivation areas, especially Lattakia and Tartous

[125] In these coupons the name of the farmer, the name of the village, and the number of seedlings are recorded.

[126] These bags are often made of polyethylene (plastic).

Table 16: Prices of citrus seedlings[127] in governmental and private nurseries (prices are in SP[128])

	2003	2006	2009
Prices in the governmental nurseries	12 – 15	30	16*
Prices in the private nurseries	50	70 – 100	-

* The governmental sale price to the private nurseries is often 1 SP more than the farmers' price. The other prices in the table are the farmers' prices.

Source: own table[129]

The provision of citrus seedlings to farmers by the Syrian government at such nominal prices and high quality is considered one of the forms of government support to this crop. Farmers are encouraged to expand cultivation of citrus through the government's contribution in reducing the costs of citrus groves establishment, as well as the annual costs resulting from patching and replacement of aging or diseased or low-rent economic trees.

With respect to biological pest control programs, natural enemies are supplied to the farmers by the citrus board for free. On the other hand, farmers have to buy insect traps[130] from the domestic market for 25 SP/trap. For particular problems which some farmers can face they can ask the citrus board for suitable control material.

Up to 2009, fertilizer supply was monopolized by the Agricultural Cooperative Bank. The required quantities of fertilizer used to be distributed to the farmers through the cooperatives in the form of credits, but there was also an unofficial parallel market controlled by a number of small-scale local traders. Those traders used to buy their fertilizer supplies from cooperative farmers. After that they sold these quantities to other farmers at high prices[131] when fertilizer supplied by the cooperatives was arriving lately or in insufficient quantities.

[127] These seedlings are one year old, planted within grow bags, and grafted by proper scions onto appropriate rootstocks. Private nurseries often plant citrus seedlings in pots made of tin and sell them to consumers at inflated prices ranging between 200 to 300 SP.

[128] See appendix 2.

[129] This table based on the data cited in some articles published on some Syrian governmental web sites in Arabic, 2009, as well as interviews with experts.
URL: http://salkhad.hot4um.com/t3175-topic;
URL: http://www.baladnaonline.net/ar/index.php?option=com_content&task=view&id=37083&Itemid=75.
URL: http://www.fasad.shukumaku.com/Content.php?id=10109.

[130] According to the citrus board instructions, two traps are recommended per dunum.

[131] The sell prices of traders are much higher than the prices of ACB.

Whereas prices through official channels were fixed by the government, prices within unofficial parallel market depend on the market. Nitrogen fertilizers and triple superphosphate are manufactured in Syria. However, due to technical problems the production declined dramatically to reach a low point in 1991 after reaching a peak in 1983. The shortfalls of nutrients are made up by imports[132] (FAO, 2006).

Fertilizers and herbicides were imported by government at the exchange rate 46 SP per US$, whilst imports of other chemicals by the private sector were subject to the commercial rate. In this way it was possible to say that Syrian government has subsidized fertilizers and herbicides indirectly by 10-15% in comparison with domestic market.

The input prices and the additional administrative costs of the Agricultural Cooperative Banks and other institutions are determined by the Supreme Agricultural Council. In case of any incurred loss, the government identifies the body which has to cover this loss. Usually, the Agricultural Cooperative Bank uses profits which are made by selling inputs to meet losses which it makes on lending.

In 2009, the Syrian Minister of Agriculture and Agrarian Reform (Dr. Adel Safar) issued a decision that liberalized the selling prices of various types of fertilizers after their sale was restricted by Syrian government through Agricultural Cooperative Bank. This decision led to an increase in selling prices of fertilizers between 51 and 193% and caused a significant increase in the citrus production costs[133].

With respect to the agricultural labor[134], a combination of family and hired labor is used in citrus orchards. In 2008, the daily wage which was paid to the agricultural labor ranged between 250-350 SP/day. There was a distinct difference in wages paid to women and men; women labor wages was 250 SP/day/woman while wages of men labor was 350 SP/day/man.

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[132] Especially of *N* whose consumption is increasing at a faster rate than that of the other fertilizers.

[133] Based on an article issued in Arabic by Damascus Center for Theoretical and Civil Rights Studies; Alahmad, Jaber. 17.09.2009. URL: http://www.dctcrs.org/s6953.htm. For more details, see appendix 21.

[134] Agricultural labor in Syria works six days a week and paid either daily or weekly wage. A few big farmers, who only use hired labor, pay daily to their workers. The worker productivity is about 300 kg/day and the average yield of citrus orchard is 28-35 ton/hectare (this number varies according to citrus varieties and climate conditions).

2.7 Agricultural Cooperative Bank (ACB) and credit policy

Up to 31.05.2011, the number of branches of the Agricultural Cooperative Bank in Syria was 106, distributed as follows: 17 in Al-Hassakah, 16 in Aleppo, 10 in Damascus and its District, 10 in Idleb, 10 in Hama, 7 in Homs, 7 in Al-Raqqa, and 29 in the other Governorates (SCB, 2011).

The tasks of the Agricultural Cooperative Bank in Syria[135] are directly related to the state's general development plan, as it is responsible for implementing the policy of agricultural crediting through devoting the necessary funds to achieve the desired agricultural development, by regularly and effectively coordinating and uniting efforts with the planning and executing bodies, especially the Ministry of Agriculture and Agrarian Reform, the Ministry of Finance, the State Planning Commission, and the General Union of Peasants.

Projects of both cooperative and private agricultural sectors are financed by the Agricultural Cooperative Bank, while state's agricultural projects are financed by government's revenues. In contrast, private capital hesitates to invest in the agricultural sector because this investment is very risky as it is affected by uncontrollable climate conditions.

Generally, credits are provided to the growers by the Bank according to the annual demand schedule[136] and the annual production plan[137] of the Ministry of Agriculture. These loans are often offered annually and farmers are not entitled to any more amounts.

Farmers in Syria make use of three types of loans according to the term of repayment:

1. Short-term loans: The term of their repayment do not exceed one year and they are mainly used in financing the seasonal inputs such as fertilizers and pesticides. These inputs[138] are provided in kind loans through a network of outlets in the farming areas. For citrus crops, for which marketing is dominated by private firms, farmers repay in

[135] Information about the ACB based on interviews with senior ACB staff in Lattakia, experts in CBD, experts in AEUs, some citrus growers in Lattakia and Tartous provinces, the Legislative Decree No. 30 of the 2005 concerning the Agricultural Cooperative Bank; URL: http://www.banquecentrale.gov.sy/main-ar.htm, and the official site of the Ministry of Finance – Syria; URL: http://www.syrianfinance.org/.

[136] These schedules are determined by a committee composed of representatives of the Bank itself, the Central Bank, the SMAAR, and the General Union of Peasants.

[137] This plan is subject to the approval of the Supreme Agricultural Council and contains estimates of the inputs required for each crop, which in turn are converted into loan amounts for each farmer.

[138] With respect to citrus see section 2.6

cash, while in case of strategic crops, for which single channel marketing systems operate, loans are repaid through deduction from the payout for the crop.

2. Medium-term loans: The term of their repayment ranges from one year up to five years. They are granted to finance the purchase of machines and agricultural machinery, the improvement of farmlands, buy and establishment of the equipment and other works which are necessary for irrigation, digging canals and wells, and other goals relating to animal investment.

3. Long-term loans: The term of their repayment is more than five years and does not exceed ten years. These loans are provided to the farmers in the case of modern irrigation and drainage projects, projects relating to the cultivation of fruit trees, and projects of processing of agricultural products, both vegetation and animal. These credits are exempted from repayment for the first five years, but the annual interest is charged from the first year.

When farmers need to borrow medium and long-term loans, they have to provide a local committee[139] by appropriate documentation constitute a guarantee of loans. Security for loans is often given either in the form of land or a personal guarantor.

Table 17 illustrates the interest rates for loans charged by Agricultural Cooperative Bank by sectors according to the data of the Central Bank of Syria in 2011.

The Agricultural Cooperative Bank gains annually 10% as delay payment plus its commission, which is 5%, in average, for one payment credits and 1.5% for more than one payment credits. While the double rate of interest will be charged until the repayment is made by the borrower if he uses the loan for some other purposes.

The Agricultural Cooperative Bank keeps records of all borrowers on the crop level and the size of loans which were advanced by it. However, the detailed data related to the size of loans which are provided annually to the citrus farmers are not available. Table 18 shows the total size of different types of loans advanced by the bank in Syria during 2007-2010.

[139] This committee is composed of representatives of the Agricultural Cooperative Bank and other government officials. The committee gives the approval for loan after verifying the guarantees provided by the borrower.

Table 17: Interest rates charged by the Agricultural Cooperative Bank in 2011, (in %)

	Private sector[1]	Cooperative sector	Public sector[2]
Short-term loans	6.0	4.5	4.5
Short-term loans exceeding 50000 SP	8.0	4.5-6.5	4.5
Medium and long-term loans	6.0	4.5-6.5	4.5
Penalty interest	10.0	10.0	10.0

[1] Private sector: *"Includes the individuals (households), enterprises, private companies and other companies that belong to mixed and cooperative sectors"*
[2] Public sector: *"Includes the central government and non-financial public enterprises"*

Source: Elaborated from (CBS, 2011; SCB, 2011).

Table 18: Loans advanced by the Agricultural Cooperative Bank and their AAGR (in %) 2007-2010 (in million SP)

Type of loans	2007	2008	2009	2010	AAGR (%) 2007-2010
Long-term	581	339	2,162	1623	40.8
Medium-term	1,063	725	197	974	-2.9
Short-term	3,213	5290	70,338	36800	125
Loans in kind	4,020	4733	7,296	7793	24.7

Source: own table based on (CBS, 2010; CBS, 2011)

It is noticeable that the amount of the donated short-term loans increased by 125% between 2007 and 2010, and reached its peak in 2009. The medium-term loans decreased by 2.9% between 2007 and 2010. In general, the long-term loans and loans in kind increased significantly by 40.8% and 24.7% respectively over the same period.

Table 19 shows the AAGR (in %) of the ACB loans during 2006-2010 for some crops and inputs.

Table 19: The AAGR (in %) of the loans offered by ACB for some agricultural crops and inputs during 2006-2010

Items	AAGR (%) 2006-2010	AAGR (%) 2006-2010
	In cash	In kind
Fruitful afforestation	-15.5	-16
Olive	10.6	19.9
Cotton	67.8	4.2
Cereals	114.4	20.2
Sugar beet	4.4	1.4
Irrigation projects	-26.5	-72.9
Vegetables	65.1	-40.8
Green houses	25.4	-
Various crops	-2.5	-23.9
Potato	60.2	-20.5

Source: own table based on (Appendix 22).

This table gives a clear picture of changes in the donated loans listed in Table 18. Obviously, the amount of the donated credits decreased by 15.5% in cash and 16% in kind between 2006 and 2010 for fruitful afforestation while it increased in cash by 25.4 for green houses. The greatest increase was in cereals by 114.4% in cash; on the other hand, the greatest decrease was in irrigation projects by 72.9% in kind.

Up to 2010, the total number of greenhouses in all Syrian provinces was 139,150 houses, of which about 85% were in Tartous and 9% in Lattakia (AASA, 2010)[140]. These percentages clarify the increase in the offered loans by ACB for greenhouses according to Table 19. This corresponds with the increase of total loans offered by ACB in Tartous for the same period according to Table 20. On the other hand, Lattakia and Tartous accounted, respectively, for approximately 77% and 20% of the total area cultivated with citrus fruit trees, 74% and 22% of total citrus trees numbers, 82% and 17% of total citrus production (AASA, 2010). This means that the cultivation of citrus as well as fruitful afforestation projects are concentrated in Lattakia. Therefore the total short and medium loans offered by ACB in Lattakia decreased during 2007-2010, (Table 20); this result is compatible with the decrease of donated credits for fruitful afforestation projects between 2006 and 2010.

[140] These percentages were calculated by researcher.

Table 20: Total loans offered by ACB in Tartous and Lattakia for 2007 & 2010 and their AAGR (in %) during 2007-2010 (Unit: 1,000 SP)

Items	2007			2010			AAGR (%) 2007-2010		
	Long	Medium	Short	Long	Medium	Short	Long	Medium	Short
Tartous	74,874	94,717	54096	238,816	171,011	151,707	47.2	21.8	41
Lattakia	60,642	114,796	53,634	114,761	82,628	24,121	23.7	-10.4	-23.4

Source: own table based on (AASA, 2007; AASA, 2010).

The senior ACB staff in Lattakia and Tartous mentioned in 2008 that most citrus growers within these provinces make use of the bank's loans, especially the loans in kind and the short-term loans. They also reported that the repayment default rate had been low for loans for citrus, but that recently defaults have increased because of lower real citrus prices.

Citrus packers and processors of citrus borrow from the Industrial Bank. They have to pay 7% per annum as interest rate for the short-term loans when they are from the public sector and 8.5% per annum if they are from private and cooperative sectors. The Industrial Bank asks for 7% as interest rate in order to give medium and long-term loans for the public sector and 9% for the private and cooperative sectors. As delay interest it imposes 12% (SCB, 2011)[141].

[141] These interest rates are applied to all agricultural manufacturers.

3. The economic perspective for citrus production in Syria

3.1 Citrus production costs

All agricultural crops, including citrus crop, are cultivated with three main components of production, namely land, water and labor (Dinar *et al.*, 2006). The economic limits to production can be affected by many factors, in particular those that affect the production costs and market demand. Falls in crop prices and/or increases in production costs will encourage contraction of the margin of cultivation towards the optimum area (Robinson, 2003). Some of these factors which determine the production costs of citrus crop are: soil, climatic conditions, the availability of water, irrigation techniques and systems, domestic labor and the farmers' technical and administrative skills (IICA, 1997; O'Connell *et al.*, 2009; O'Connell *et al.*, 2011).

In general, the total costs of production are the sum of two ingredients: the fixed costs and the variable costs (Makeham and Malcolm, 1985). In other words, total costs equal fixed costs plus variable costs (Taylor and Weerapana, 2011):

$$TC = FC + VC$$

According to Makeham and Malcolm (1985), Arnold (2008), Shim and Siegal (2009), WTO (2010), and Taylor and Weerapana (2011), fixed costs[142] are defined as the costs which remain constant in total regardless of changes in activity. They are, in other meaning, not directly related to the amount of crop grown in the short run and they have to be paid whether anything is produced or not. Items included under fixed costs include the rent of land, taxes of land, costs of buying machines, depreciation costs of the fixed assets, loan repayments, and all other things and equipment that do not change when crop production changes in the short run.

Variable or direct costs are defined as the costs which vary in total in direct ratio to changes in activity. They are the part of total costs that varies in the short run as production changes. Variable costs are directly related to the amount of crop produced and so with the amount of variable inputs such as wage payments for workers, gasoline for trucks, fertilizer for crops, and all other things that change when the amount produced changed.

The average fixed costs tend to fall as the quantity of output increases, i.e. the more output is produced, the lower the amount of fixed costs involved in the making of each unit of output.

[142] They are also called: overhead costs or indirect costs.

In contrast, the average variable costs tend to increase as output increases, i.e. as more and more variable inputs (e.g. fertilizer) are used, then each extra input adds less to output. So, it takes more and more input to produce an extra unit of output[143].

With respect to production costs of citrus in Syria, Table 21 demonstrates the production costs average for one hectare of citrus during 2007-2009 and its AAGR (in %) for the same period. This table shows three types of costs:

1. Fixed costs which depend on the value of equipment, the life of the machines, the depreciation of capital, and the cost of both wells digging and land rent. These costs have been estimated per unit of cultivated area (one hectare).

2. Costs of agricultural operations: Agricultural operations can be divided into two categories, manual labor and mechanical labor. In order to harvest and pack their citrus crop, a few farmers rely on family labor while others depend on both family and hired labor, and some few big farmers use only hired labor. While direct labor includes all hired labor used for one hectare, the family labor is estimated for each agricultural operation at market wage[144].

3. Costs of production requirements: Production requirements refer to some inputs like seedlings, organic and chemical fertilizer, containers, chemical control materials and irrigation water[145].

It is noticeable in Table 21 that the cost of citrus production per kg increased by 24% during 2007-2009, as a result of increases in the total cost of the agricultural operations and the total cost of production requirements[146].

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[143] Principle of diminishing returns, which means, it eventually requires more and more variable costs to produce an extra unit of output, i.e. average variable cost tend to increase as output increases (e.g. fertilizer per kilogram of grain).

[144] See section 2.6.

[145] More information about the costs of citrus production inputs are in the section 2.4.2.1 and section 2.6.

[146] The proportions of increase in the different types of costs are clarified in Table 21.

Table 21: Production costs average of citrus fruit trees and its AAGR (%) 2007-2009 (Unit: SP/hectare)

Cost type	Item	2007	2008	2009	2010	AAGR
1. Agricultural operations	Ploughing	4361	4903	4893	4893	6%
	Hoeing and weeding	8271	9268	9262	9262	6%
	Trough	6000	7075	8760	8760	21%
	Breeding & pruning & wood collecting	8552	10150	13243	13243	24%
	Irrigation costs	13805	15548	30286	30286	**48%**
	Chemical control	1914	2440	3269	3786	**31%**
	Organic fertilisation	2200	2610	4125	4125	**37%**
	Chemical fertilisation	1993	1316	2214	2214	5%
	Harvesting (12-15% of production/year)	9061	8991	17462	17462	**39%**
	Sorting & packing	2265	2248	4366	4366	**39%**
	Loading & unloading	2899	2877	2976	2976	1%
	Crops transportation	11342	17174	16015	16015	19%
	Guarding	2762	0	4583	0	29%
	Total	**75425**	**84600**	**121454**	**117388**	**27%**
2. Production requirements	Organic fertilizer value	11447	12000	12262	12262	3%
	Chemical fertilizer value	14196	14195	46941	45261	**82%**
	Containers value	24162	23975	24800	24800	1%
	Chemical control materials value	6843	7595	8708	9044	13%
	Irrigation water value	8801	8911	9574	7535	4%
	Total	**65449**	**66676**	**102285**	**98902**	**25%**
3. (7.5%) of interest capital		4909	7564	7671	6852	25%
4. (5%) incidental epenses		7044	5001	11187	4945	26%
5. Costs of fruiting year (of the establishment years costs)		**22183**	**24893**	**32759**	**25374**	**22%**
6. Total of costs = (1+2+3+4+5)		175010	188734	275356	253461	25%
7. Land rent (15%) of production		**31250**	**33679**	**49103**	**45121**	**25%**
8. Total of costs = (6+7) , Unit: SP/hectare		**206260**	**222413**	**324459**	**298582**	**25%**
9. Yield average (5 Years) kg/hectare.		28426	28207	29176	29176	1%
10. Cost of (1 Kg) = (8/9); Unit: SP/kg		**7.26**	**7.89**	**11.12**	**10.23**	**24%**

***Source*:** own calculation based on data in the (Table 156) of the (AASA, 2010)

The main reasons of cost increases can be summarized in the following[147]:

1. The Syrian agricultural sector witnessed a decline during 2007 and 2008, due to the drought and liberalization of the Syrian markets[148]. These conditions forced many of the agricultural workers, especially the seasonal and irregular labor, to leave work within the agricultural sector and transit to other works in order to obtain better sources of income. This issue resulted in increased wages of the agricultural labor, in particular, the specialized one, which reflected negatively on farmers and producers and significantly contributed to raising costs of agricultural operations (Table 21).

2. The rising of fertilizer prices, globally and locally[149], simultaneously with the doubling of energy prices and the contraction in the global economy, in addition to the cancellation of the government subsidies on petroleum products in Syria, particularly diesel fuel[150]. These changes led to a significant increase in the chemical fertilizer value (by 82% in average), and to rising transportation costs of harvested citrus crop and other agricultural operations which mainly depend on diesel fuel as a major resource of energy, for instance irrigation and chemical control (Table 21).

Table 22: Composition of citrus production costs during 2007-2009; (Unit: %)

Item	2007	2008	2009	2010	ACR% (09-10)
Agricultural operations	36.6	38	37.4	39.3	+5.1
Production requirements	31.7	30	31.5	33.1	+5.1
Costs of fruiting year	10.8	11.2	10.1	8.5	-15.8
Land rent, 15% of production	15.2	15.1	15.1	15.1	0
Others	5.8	5.7	5.9	4	-32.2
Total cost	100	100	100	100	

Source: own calculation based on data in the (Table 156) of the (AASA, 2010)

147 Information is based on an interview (issued in Arabic) on the official SMAAR web site at the 24th of January, 2010, with an expert of Agricultural Economic Directorate in the SMAAR. URL: http://moaar.gov.sy/main/archives/1093.

148 See section 2.1.

149 See appendix 21 and section (2.6).

150 This because it absorbs the majority of the subsidy mass, which amount 7 billion SP annually; price of 1 liter of diesel fuel increased by 28%, from 7 SP/liter to 25 SP/liter during 2007-2008.

As shown in Table 22, the highest shares of citrus production costs were for agricultural operations and for production requirements. These ratios remained, roughly, constant during 2007-2009. Also the cost of citrus production per kg decreased in 2010 by 8% than the cost in 2009; however, this was not due to the decline of total agricultural operations cost and/or the total cost of production inputs, but as a result of decline the costs of fruiting year (by 15%), and the costs of the incidental expenses and the interest capital (by 32.2%). Consequently, this decrease in the cost of citrus production per kg in 2010 cannot be considered as a real indicator because it is a consequence of decline in costs estimated[151] by the experts in the Agricultural Economic Directorate within the SMAAR in cooperation with the experts of the Agricultural Directorates in Lattakia and Tartous.

3.2 Comparative advantage of the Syrian citrus fruit

The current age is the era of economic evolutions and international changes, especially after the technology revolution and the emergence of multifarious forms of globalization and the resultant connection between the economies of developing countries and the economies of developed countries. In other meaning, the world has become a small village where no nation is isolated from the effects of the rest world, because the separation and insularity are not good for any country especially the developing ones.

Under such contemporary developments into international economic relations, the importance of research and study about the commercial exchange between countries has increased, especially after the heavily reliance on international markets in disposal of domestic products and the provision of others. Because nations cannot produce all their needs of goods and services, they specialize in producing certain goods and services in accordance with their economic conditions at lower cost and more efficiently than other nations. This is possible where such commodities are characterized by local and international comparative advantages,

[151] These costs are estimated by depending on certain ratios, (7.5%) of interest capital and (5%) incidental expenses. The costs of fruiting year (of the establishment years costs) are calculated by assuming that there is a distinct establishment period of the first six years during which there is no yield or income; followed by a period of (25 years) during which yields are constant, this period is called the “economic life period of the citrus tree”. After this period the tree production begins to deteriorate. The establishment costs are then spread equally over each year of the 25 years period. Costs of fruiting year = total costs during the years before fruiting/ economic life period of the citrus tree. The value of citrus seedlings and the windbreak seedlings and other costs related to the establishment of a citrus orchard are part of the total costs during the years before fruiting (the first six years).

which helps these nations to exchange them with products from others. This process is known as international commercial exchange.

The comparative advantage is defined as: "*the advantage in the production of a product enjoyed by one country over another when that product can be produced at lower cost in terms of other goods than it could be in the other country*" (Tönnis, 2007).

This principle and the comparative advantage concept of David Ricardo, which applies to a world without significant trade barriers, forcefully argue against self-sufficiency in the time of economic globalization and the liberalization of markets and trade (Ryan, 2001). Nations are seeking for distinction in producing a wider range of goods and services, that have comparative advantage, by utilizing their full potential of domestic resources, like labor, capital, land etc., and making use of the experiences of others to achieve a surplus for export or equilibrium in the balance of their payments. Thus, the comparative advantage of any production sector includes a set of concepts related to the identification and analysis of the costs and revenues of this sector (Siggel, 2007).

The Syrian economy, as a part of the global economy, has gradually turned from a government-oriented economy to a social market economy. This transformation will more broadly pave the way for its openness to the international economy and international competition. Particularly after the recent changes that have taken place during the last decade, which were characterized by Syria joining the Greater Arab Free Trade Area (GAFTA)[152], showing readiness to sign the Association Agreement with the European Union[153] in order to have a better access to European markets and to gradually liberalize its economy and preparation for accession into the WTO[154].

These regional and global transitions and changes widely opened the door to the exposure of Syrian products to foreign competition, both products of the agricultural sector or the industrial sector, in particular, the agricultural and food industries. So it is very necessary to analyze the impact of such variables on the agricultural and industrial sectors, because of their

[152] The GAFTA agreement became effective in 2005, see section (4.4.4).

[153] In October 2009, the Syrian government told the European Union through the Minister of Foreign Affairs Walid Al-Moallem her refusal to sign the Association Agreement on the date set by the European Union on October 26, 2009. The EU approval came after Syrian government and the EU signed in initials the amended text of the Association Agreement in December, 2008; after freezing the convention since 2004 due to political reasons, see section (4.4.4). URL: http://syria-news.com/readnews.php?sy_seq=102990.

[154] On the 4th of May 2010, Syria was accepted as an observer member in the WTO.

great importance in the Syrian economy, due to their contribution to the GDP and employment creation for the labor force, but also as a source of hard currencies gained by export.

The integration with the global economy put these sectors face to face with a lot of challenges, especially the sector of promising crops and the sector of strategic crops which make use of the government support and different levels of trade protection. Concurrently, for other crops that have not benefited from any particular governmental support during the past decades, the larger integration of the Syrian economy in the world market may provide new opportunities for expansion. However, in this case also, their actual potential for competing with other countries exporting similar products remains an issue.

In order to determine the possibility of adapting these crops and related agro-industries products to an open economic environment and trade liberalization and their ability to compete in the international markets; the Syrian Ministry of Agriculture and Agrarian Reform, represented by the National Agricultural Policy Centre (NAPC), with collaboration of (FAO) and the Government of Italy, has carried out systematic studies of the comparative advantage of selected agricultural commodities (cotton, wheat, olive, tomato, orange and livestock), in order to provide the necessary information base for decision making.

Syria has achieved self-sufficiency[155] as a result of applying certain policies in order to encourage and develop the cultivation and production of citrus fruit, and in the recent years it tended to find foreign markets, whether regional or global, through which it can export the surplus of citrus production[156]. According to these transformations, it becomes very important to know whether the produce of citrus fruits in Syria has a comparative advantage or not. If it has, the surplus of citrus production will be able to enter the foreign markets and to achieve the desired goal of export process, in order to assess the efficiency of the use of local resources in Syria with respect to the produce of citrus fruits; and to evaluate the effects of the trade globalization, the economic openness, and the challenges which will face these exports.

In 2006, the NAPC analyzed the comparative advantages of fresh oranges and orange concentrates. This study found that Syria had a comparative advantage in the production of fresh table oranges and did not have a comparative advantage in growing oranges for use in the manufacture of concentrate for export (Snouber, 2006).

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[155] During 1990s Syria was a net importer of citrus fruit.

[156] See sections 2.2 & 2.3.

3.2.1 Methodology used in analyzing the comparative advantage of an agricultural system

The assessment of the comparative advantage of any productive system requires analyzing and studying a wide range of concepts such as: cost, revenue, and the theory of international trade to determine if a country produces a commodity by relying on its own domestic resources (labor, capital, land)[157], and it is able to compete with the alternative imported items or the counterpart goods within the international markets (Monke and Pearson, 1989).

Practically, in this study the comparative advantage of the citrus production system in Syria will be measured through an analytical framework, named the Policy Analysis Matrix (PAM)[158]. This matrix is based on a simple arithmetic identical: Profit = Revenue – Cost.

Or, in symbols:

$$NSP = E(Pq)Q - E(Pt)IT - (Pn)IN$$

Where:

NSP: Net profit.

E: Exchange rate of the foreign currency.

Pq: Price of the product.

Pt: Price of the tradable inputs.

Pn: Price of the domestic factors (non-tradable input).

Q: Quantity of the outputs (Production).

IT: Quantity of the tradable inputs.

IN: Quantity of the domestic factors (non-tradable input).

This accounting identity is computed by using two price systems, either by relying on social prices or on private prices.

[157] This represents the essence of the comparative advantage theory to produce a national commodity.

[158] PAM is a computation of several accounting entities and ratios which have been gradually developed and consolidated by applied research into one analytical framework.

The distinction between tradable input and domestic factors is the core of the conceptual framework to build the PAM. The structure of PAM consists of three rows and four columns. The columns include (Table 23):

1. Revenues in the left-hand one.
2. Two cost columns in the middle, one for tradable inputs and the other for domestic factors. The intermediate inputs, which include: fertilizer, pesticides, purchased seedlings, electricity, transportation, and fuel, are divided into their tradable-input and domestic factor components. In other words, tradable are goods and services that can be internationally traded. The category includes both intermediate inputs required during the process of production, and the final output of the production process, while the domestic factors include basically labor, land, and the capital[159] required to produce the final output.
3. Profits, which are shown in the right-hand column and calculated by subtracting the cost of inputs from production revenue.

The PAM rows include (Table 23):

1. *Private profitability:* It is the measured data which is shown in the first row of the table. In other words, this row is intended to calculate the budget[160] of considered product at the actual market prices received or paid by farmers, merchants, or processors in the agricultural system.
2. *Social profitability:* These valuations measure comparative advantage or efficiency in the agricultural commodity system. In other words, this row is intended to calculate the budget of considered product by using social prices.
3. *Effects of divergences:* The third row of the matrix concerns the differences between private and social valuations of revenues, costs, and profits.

[159] Although, labor and capital cannot be any more considered as (pure) domestic factors in a globalized world where international migrations are frequent and where financial markets are increasingly integrated. However it is considered that the price or the value of domestic factors is mainly determined by local factor markets conditions, especially for labor.

[160] Revenues, Costs, and Profits

Table 23: Policy Analysis Matrix (PAM)

	Revenue	Costs		Profits
		Tradable inputs	Domestic factors	
Private prices[161]	A	B	C	D
Social prices[162]	E	F	G	H
Effects of divergences and efficient policy (divergence)	I	J	K	L

A: total revenues at private prices.

B: the costs of tradable inputs at private prices.

C: the costs of domestic factors at private prices.

D: private profits (D = A – B – C)

E: total revenues at social prices.

F: the costs of tradable inputs at social prices.

G: the costs of domestic factors at social prices.

H: social profits (H = E – F – G)

I: output transfers or the impact of policy on production (I = A – E).

J: input transfers (J = B – F).

K: factor transfers (K = C – G).

L: net transfers or the net impact of politics (L = D – H); they also equal (I – J – K).

Source: Elaborated from (Monke and Pearson, 1989)

Straightforwardly, the PAM provides policy-makers with a broad range of indicators and benchmarks for assessing the efficiency and the comparative advantages of an economic system. Table 24 presents some of these indicators and benchmarks.

[161] Private prices are the prices currently used by the different agents (farmers, merchants, or processors) in order to purchase their inputs and domestic factors and to sell their outputs.

[162] Social prices are the prices that would prevail if the value of tradable inputs and outputs and domestic factors were not modified either by the economic policy in place (tax, subsidy, price intervention) or by output, input or factors markets failures (market segmentation) which result in a distorted price system.

Table 24: Some indicators and benchmarks of the Policy Analysis Matrix (PAM)

Indicators and Benchmarks	Equations	Interpretation and Commentary
Financial Profitability (FP)	[D = A-B-C]	The absolute value of the profit at private prices.
Social Profitability (SP)	[H = E-F-G]	The absolute value of the profit at social prices.
Financial Cost Benefit Ratio (FCB)	[FCB = C/(A-B)]	The competitive indicator of the system: If FCB > 1 the system is not competitor[163] and the financial profitability is negative; if FCB < 1 system is competitor[164].
Domestic Resource Cost Ratio (DRC)	[DRC = G/(E-F)]	The comparative advantage indicator of the system: If DRC < 1 the system has a comparative advantage[165]; if DRC > 1 the system has no comparative advantage[166].
Social Benefit Cost Ratio (SBC)	[SBC = (F + G)/E]	Another indicator to measure the comparative advantage of a system: it takes into account the total cost of production (F + G) rather than the domestic factors only.
Net Transfers	[L = I-J-K]	The absolute value of transfers between the economy and the system[167].
Nominal Protection Coefficient on Tradable Outputs (NPCO)	[NPCO = A/E]	Indicates to the level of the main product protection[168]: if NPCO > 1 the system benefits from a protection since it gets higher revenue at private prices than it would get at social prices. If NPCO < 1 the

[163] The systems utilize more value of domestic factors than it the wealth created or the value added, and then the system is not profitable.

[164] The system is profitable.

[165] The system is said to be economically efficient.

[166] The social profitability is negative.

[167] Net transfers are caused by policy and market failures. Disaggregation of the total net transfer shows whether each distorting policy provides positive or negative transfers to the system; thus, the PAM permits comparison of the effects of market failures and distorting policies for the entire set of commodity and macro-price (factor and exchange-rate) policies. This comparison can be made for the complete agricultural system and for each of its outputs and inputs.

[168] The NPC is a ratio that contrasts the observed (private) commodity price with a comparable world (social) price. This ratio indicates the impact of policy (and of any market failures not corrected by efficient policy) that causes a divergence between the two prices.

		system is subject to taxes and the main output in undervalued at private prices resulting in a transfer of wealth from the productive system to the rest of the economy.
Effective Protection Coefficient (EPC)[169]	[EPC = (A-B)/(E-F)]	It compares the added value at private price to added value at social prices which give a combined index of the level of trade distortion on both tradable inputs and outputs; it provides a more accurate measure of the level of protection than the NCP.

Source: Elaborated from (Monke and Pearson, 1989)

There are some more indicators in addition to the previous:

1. Subsidy Ratio to Producer (SRP): SRP = L/E or (D-H)/E
2. Profitability Coefficient (PC): PC = (A-B-C)/(E-F-G) or D/H
3. Equivalent Producer Subsidy (EPS): EPS = L/A

3.2.2 The used measures in analyzing the comparative advantage of the Syrian citrus production

As mentioned in Table 24, there are a lot of indicators and measures which are used to analyze the comparative advantage of a productive system; however, this study will focus on the use of certain indicators to assess the comparative advantage of citrus fruit in Syria, as a part of a productive agricultural system, and to measure its efficiency and competitiveness:

1. Financial Cost Benefit Ratio (FCB $FCB = [C/(A-B)]$) which is the competitive indicator of the system:

   If (FCB) > 1: the system is not competitor.

   If (FCB) < 1: the system is competitor.

2. Domestic Resource Cost Ratio (DRC) which is the comparative advantage indicator of the system and used to measures the efficiency of domestic production for the global

[169] If EPC > 1 that is mean the selected systems is protected, while if EPC < 1 means that the system generates less added value at market price than it would at social prices.

markets. In other words, it measure the economic efficiency or the comparative advantage within the international exchange rates:

$$DRC = [G / (E - F)]$$

If (DRC) < 1: The system has a comparative advantage, that means, the domestic resources (labor and capital) are used to a lower value and the country, in this case, has a comparative advantage in producing the product in comparison with the costs of its importation.[170] Therefore it is preferable to expand in producing the product locally.

If (DRC) > 1: The system has no comparative advantage. Therefore, the country will not be able to compete globally in producing the product.[171] In this case, it would be preferable to convert the used resources in producing the product and utilize them in producing a product or other commodities which has high efficient productivity and profitability, and has a comparative advantage to compete in the global markets.

If (DRC) = 1: This means its analogous profitability measure equals 0. In other words, it reaches the break-even point, and hence, there is a possibility to continue producing the product whereas the distribution of the productive resources has reached the optimum point to some extent.

Minimizing the DRC is thus equivalent to maximizing social profits. DRC ratios replace social profit measures as indicators of relative degrees of efficiency in cross-commodity comparison.

3. Social Benefit Cost (SBC):

$$SCB = [(F + G) / E]$$

It is considered another indicator to measure the comparative advantage of a productive system. It takes into account the total cost of production (F + G) rather than the domestic factors (G) only which discriminate for the system that includes a greater amount of tradable inputs. Therefore it is more convenient and accurate to study the

[170] The importation costs are more than the costs of its production domestically.

[171] The country has no comparative advantage in producing the product.

relative position of the studied production systems when they have different cost structures (i.e. tradable and non-tradable).

3.2.3 Costs of citrus production at market prices (private prices)

All the required information was gathered by visiting the agricultural directorates and departments in Lattakia and Tartous governorates[172] and from the interviews with farmers and experts from institutional sources. There were some gaps of information of primary and secondary data because, in general, some of the agents of the commodity chain were closed and non-cooperative. So it was very necessary to go back to the secondary data of official sources like documentations of the Ministry of Agriculture and Agrarian Reform (SMAAR) and the Ministry of Economy and Trade, the Central Bureau of Statistical, the Annual Agricultural Statistical Abstract for the years 2007, 2008, 2009, and 2010, and many reports which belong to a FAO project in the NAPC (Westlake, 2000; Westlake, 2001; Varela-Ortega and Sagardoy, 2001; Horst, 2006; Frederic, 2004; Snouber, 2006).

Standard budget will be prepared and conducted for the total citrus production system and for one hectare of the cultivated citrus trees. This budget includes the costs, revenue, and profit. Generally, the citrus production costs are divided into the following items

1. Fixed costs.
2. Direct labor.
3. Intermediate inputs.

It is very necessary to distinguish between two types of costs within each group of these items: the costs of tradable input and the costs of non-tradable input (domestic factors) which are represented by labor, capital, and land. This distinction is the cornerstone of the PAM concept.

1. **<u>Fixed costs</u>**

Principally, fixed costs are determined by equipment's actual value, equipment's life time, equipment's salvage value, capital depreciation (% used of this machine for main line), and the theoretical and actual capacity of the line. These costs are paid, regardless of the achievement of the production process and generally includes the agricultural machines, the

[172] Since the cultivation of citrus fruit in Syria is concentrated in these two governorates.

establishment expenses, wells, trucks, generators and pumps etc. The information on life and salvage value of the equipment is needed to evaluate the fixed and capital equipment inputs. In order to determine the annual equivalent costs of the fixed inputs, the capital recovery factors are applied. Then the costs are multiplied by the share of total annual use (for example, hours per hectare divided by hours per year) to derive the fixed input costs for the activity budget. Furthermore, the identification of the costs of agricultural machinery, such as tractors, plows, harrows, planes, and wagons, is needed individually.

It is difficult to calculate the fixed costs of the citrus production operations, because it is time consuming and difficult to know the used up value or the share of each mechanized operations for each crop since the farmers follow the agricultural rotation and may plant more than one crop in the same land in the same period. Therefore, it is assumed that all the required operations to cultivate the land and mechanized labor on the farm level are services and considered as variable cost, and all the mechanized operations are rented[173]. However, some costs are considered fixed cost like the pipe of drip irrigation. In other words, these costs will be divided into their basic components, the costs of tradable input and the costs of non-tradable input (domestic factors) which include the Qualified Labor[174] (QL), Non-Qualified Labor[175] (N-QL), and capital, according to private transactions.

Citrus trees are perennial crops and have an economic life period[176] of 25 years in average. After this period the tree production begins to deteriorate. There are two periods of production according to the fruiting stages of the citrus trees; the establishment period and the full fruiting period. The establishment period extends to the first 6 years, and the costs during this period are considered fixed costs and called the establishment cost of the investment.The full fruiting period extends to the next 25 years, and the costs during this period are considered variable cost.

[173] It will be much easier to calculate the cost of one hour and the required hours of each operation when the mechanized operations are considered as rented labor.

[174] Qualified Labor: is the skilled labor that is subject to the official employment contracts with the existence of the social insurance and retirement system; this category includes engineers, technicians, and drivers … etc.

[175] Non-Qualified Labor: is the unskilled labor which called also the seasonal labor; this type of workers are working without official employment contracts and most of them are getting their wages on a daily basis.

[176] Or the full fruiting period, See section (3.1).

2. Direct labor

Direct labor includes all the hired labor[177] that is used to serve one hectare or one citrus tree. It is valued at the basis of the market wages for each type of agricultural operation[178]. The quantities and price information are sufficient to calculate the private cost for direct labor, intermediate inputs, and outputs. Also, inputs have to be identified with a high degree of specificity because each input is evaluated at both social and private prices. In general, direct labor is considered as a domestic factor (non-tradable input) and often divided into two types, Qualified Labor (QL) and Non-Qualified Labor (N-QL), since these categories of labor usually have private market wages and social opportunity costs.

3. Intermediate inputs

Intermediate inputs are the variable costs of the inputs which include seeds and seedlings, chemical inputs, mechanized labor paid as service, water delivery costs, and output value for the main product and by-product (Table 21). Due to the absence of a comprehensive data set of the cost and returns for all types of crops[179], the opportunity cost of the land is considered as a share of production. However, available estimates of land rent will be used to assess the profitability of the selected systems at the aggregate level, by comparing them with the value of the profit.

Most of the produced citrus fruit in Syria is irrigated by using three systems in accordance with the water resources, the methods of irrigation, and technique as following[180]:

1. Public net irrigation technique: In this system the calculated cost depends on the fees and wages which are imposed by government upon the citrus growers and other beneficiaries of this net.
2. Well irrigation technique by flood (gravity) and well irrigation technique by drip: In these two systems, it is very important to take into account the costs of drilling and equipping[181] the well in order to calculate the irrigation costs per hectare.

[177] Family labor is evaluated as the hired labor at the basis of the market wages, as well.

[178] As noticeable in Table 21, for instance.

[179] It also makes the estimation of the costs of land per type of land at both market price (the current observed price) and social price; difficult.

[180] See section 2.4.2.1.

These costs are distributed into tradable and non-tradable costs (domestic factors) according to private certified transactions.

To study the comparative cost of citrus production per hectare, the average of the different cost values has been taken by relying on AASA (2007) to get the average cost of produced citrus fruit per hectare. Then these costs were classified into Tradable Inputs (TI) and Domestic Factors (DF) as shown in Table 25 which illustrates the distribution ratios.

Table 26 clarifies the production cost of citrus fruit per hectare depending on the distribution ratios presented in Table 25. It shows that in 2006,[182] the total cost average of the produced citrus fruit in Syria per hectare (TC/Hectare) was 201076 SP/Hectare. However, the production cost average of (1 kg) of Syrian citrus fruit in 2006 was 7.03 SP/kg; (AASA, 2007). And hence, the production cost of (1 ton) of Syrian citrus fruit equals (7030) SP/ton.

Since the main objective of the study is to assess the comparative advantage of the exported fresh citrus fruit as depicted in Figure 16, it is very important to identify the costs of sorting and packaging operations of the harvested citrus fruit. These operations include:

1. Product sorting according to the quality.
2. Washing fruits by cold water and chemicals.
3. Packaging.
4. Promotion and marketing.
5. Exporting to the foreign markets.

The costs of these operations are studied on the basis of one ton and also classified, into fixed costs, intermediate input, and direct labor. The direct labor in this stage forms a small proportion and includes the qualified labor (drivers, merchants, and storekeepers) and non-qualified labor (loading and unloading labor). The fixed costs are the value of the transport vehicles. The intermediate inputs are fuel, value of the electricity, the value of the special plastic boxes for export etc.

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[181] The costs of establishment and drilling the well in addition to the cost of pump and pipes are considered as fixed costs; while the costs of pumping water and the process of irrigation are considered as variable costs.

[182] The year 2006 was adopted as a reference year to study the comparative advantage of citrus fruit in Syria, because it represented an ideal period, since the production of citrus fruit was not subjected to fluctuations in either terms of cost changes and climate conditions, or even the economic and political situation, to some extent.

Table 25: The distribution of cost average ratios of the produced citrus fruit in Syria per hectare in 2006; Unit: SP/Hectare

Cost type	Cost average	Transactions of cost Distribution into Tradable Input & Domestic Factors			
		TI	DF		
			QL	N-Q	K
Fixed costs (A)					
Establishment cost	20737	24%	2%	24%	50%
Total (A)	**20737 (A)**				
Direct labor (B)					
Ploughing	4357			100%	
Hoeing & weeding	8147			100%	
Trough	6000			100%	
Breeding & pruning & Wood collecting	8427			100%	
Irrigation costs	13830			100%	
Chemical control	1813			100%	
Organic fertilization	2213			100%	
Chemical fertilization	1857			100%	
Harvesting (12-15% of production/year)	9111			100%	
Sorting & Packing	2278			100%	
Loading & Unloading	2915			100%	
Crops transportation	11406			100%	
Guarding	2560			100%	
Total (B)	**74914 (B)**				
Intermediate inputs I					
Organic fertilizer value	10862	72%	4%	7%	17%
Chemical fertilizer value	14196	80%	5%	5%	10%
Containers value	24298	80%	5%	5%	10%
Chemical control materials value	6333	80%	5%	5%	10%
Irrigation water value	8974	40%	10%	10%	40%
Total inputs (X)	**64663**				
Sum (X + B)	**139577**				
4.5% of Interest capital	2910	24%	2%	24%	50%
5% Incidental expenses	6979	45%	5%	33%	17%
Land Rent 15% of production	30873	0%	0%	0%	100%
Total I	**105425 I**				
Total cost (TC)	**201076**				

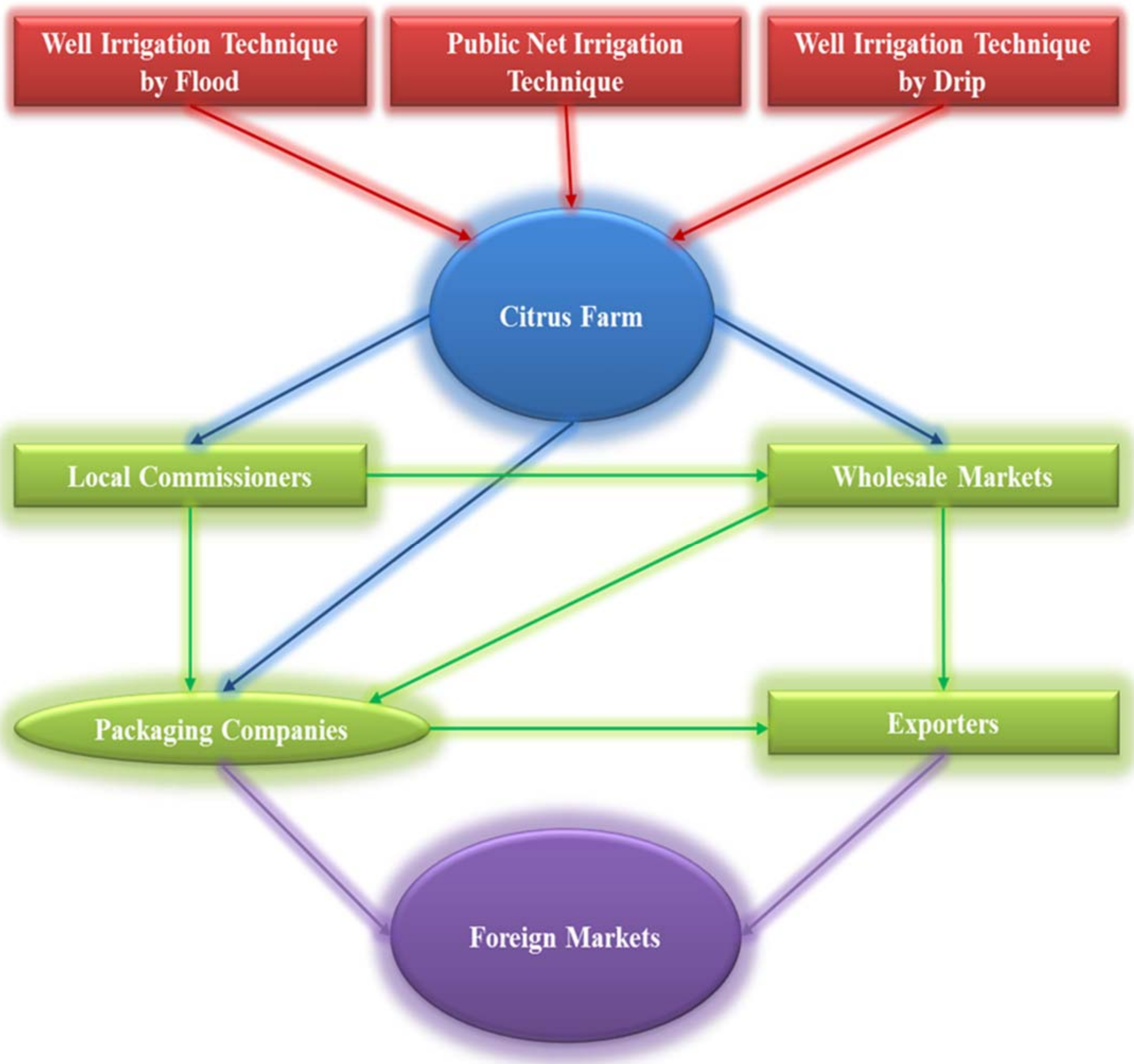
Source: Own table based on (Frederic, 2004; Snouber, 2006; AASA, 2007).

Table 26: The cost average of the produced citrus fruit in Syria per hectare in 2009; Unit: SP/Hectare

Cost type	Cost average	Transactions of cost Distribution into Tradable Input & Domestic Factors			
		TI	DF		
			QL	N-Q	K
Fixed costs (A)					
Establishment cost	20737	4977	415	4977	10368
Total (A)	**20737**	**4977**	**415**	**4977**	**10368**
Direct labor (B)					
Ploughing	4357	0	0	4357	0
Hoeing & weeding	8147	0	0	8147	0
Trough	6000	0	0	6000	0
Breeding & pruning & Wood collecting	8427	0	0	8427	0
Irrigation costs	13830	0	0	13830	0
Chemical control	1813	0	0	1813	0
Organic fertilization	2213	0	0	2213	0
Chemical fertilization	1857	0	0	1857	0
Harvesting (12-15% of production/year)	9111	0	0	9111	0
Sorting & Packing	2278	0	0	2278	0
Loading & Unloading	2915	0	0	2915	0
Crops transportation	11406	0	0	11406	0
Guarding	2560	0	0	2560	0
Total (B)	**74914**	**0**	**0**	**74914**	**0**
Intermediate inputs I					
Organic fertilizer value	10862	7820.6	434.5	760.4	1846.5
Chemical fertilizer value	14196	11356.8	709.8	709.8	1419.6
Containers value	24298	19438.4	1214.9	1214.9	2429.8
Chemical control materials value	6333	5066.5	316.6	316.6	633.3
Irrigation water value	8974	3589.5	897.4	897.4	3589.5
Total inputs (X)	**64663**	**47271.8**	**3573.2**	**3899.2**	**9918.7**
Sum (X + B)	**139577**				
4.5% of Interest capital	2910	698.4	58.2	698.4	1455
5% Incidental expenses	6979	3141	349	2303	1186
Land Rent 15% of production	30873	0	0	0	30873
Total I	**105425**	**51111.2**	**3980.4**	**6900.6**	**43432.7**
Total cost (TC)	**201076**	**56088.2**	**4395.4**	**86791.6**	**53800.7**

Source: Own table based on (Table 25)

Figure 16: The supply chain of exported citrus fruit in Syria



Source: Own figure.

Table 27: The distribution of cost disaggregation coefficients ratios of the produced and processed citrus fruit per ton (in %)

	The distribution of cost disaggregation Coefficients Ratios	
	Tradable Inputs (TI)	Domestic Factors (DF)
The cost per ton of product [1] (%)	28%	72%
Processing cost per ton (%)	59%	41%

[1] Ratios were calculated by researcher according to Table 26.

Source: Own table based on (Snouber, 2006).

Table 28: Total cost at private price for producing one ton of exported citrus fruit; (Unit: SP/Ton)

		The distribution of disaggregation coefficients of processing cost (per ton)	
		Tradable Inputs (TI)	Domestic Factors (DF)
The cost per ton of product	7030	1968.4	5061.6
Processing cost per ton	(1930) [1]	1138.7	791.3
Total cost per ton	8960	3107.1	5852.9

[1] Based on the information and data that were obtained from a specialized company for packaging fruits and vegetables in the Rif Dimashq Governorate, Adra city, in 2008.

Source**:** Own calculation based on Table 25, Table 26, and Table 27.

Table 28 illustrates the total cost per ton of produced citrus fruit, which is intended for export to the foreign markets. The total cost is 8960 SP/ton, of which approximately 65% are a domestic factor and 35% are a tradable input[183].

3.2.4 Costs of citrus production at social prices (economic prices)

The construction of the citrus PAM at the social prices depends on studying the index of prevailing distortion between the reality of the market and the current policies on the one hand and the reality which can prevail in the case of distortions absence due to the government policies or market distortions on the other hand. Therefore, it is important to know the representative system's data (cost and revenue) at the social prices through the correction of the prevailing market price on the basis of price distortions which have been determined. To compute the second row of the citrus PAM at social prices, it is necessary to estimate two types of values:

1. <u>Estimating the values of domestic factors at social prices:</u>

In order to estimate these values, the concepts of macroeconomic must be used to identify some variables like exchange rate, interest price, labor market etc. However, the social value (economic value) of domestic factors cannot be assessed as the tradable inputs, by relying on the global prices, but it is estimated on the basis of the opportunity cost.

[183] Own calculation, based on Table 27 and Table 28.

For labor market, it was assumed that there is no particular distortion on the labor market and that the current wages reflect the true opportunity cost of labor. Here, it is very important to distinguish between qualified labor (QL) and non-qualified labor (N-QL) because the skilled labor (permanent labor) has to pay various social contributions and pension fee (e.g. 7% of the wage is taken by government as social insurance, 14% is paid by the employer, and 3% is paid as health insurance). But, since the majority of agricultural labor is seasonal labor (N-QL) (Table 25), its value has been taken at the market price (private price).

For the capital market, an interest rate of 3% equivalent to the weighted rate computed by the IMF for the newly industrialized Asian economies was applied at social prices.

2. <u>Estimating the parity price of tradable input and output at social prices:</u>

The PAM is estimated in the Syrian pound, while the value of tradable input is usually quoted in US$ on the world market, therefore the exchange rate is an important determinant of the value of tradable input which needs to be converted in SP. Consequently, a unified exchange rate[184] has been adopted to estimate the private and the social value of the tradable input and output.

For major tradable agricultural inputs, the latest unified duty is used to calculate the social price after the deduction of taxes applied whenever imported. The parity price for tradable outputs means the price that equals to the international or border price at the parity point[185]. This point takes into consideration the domestic transportation, processing, and marketing costs. The resulting farm gate prices[186] are estimated as following:

1. Identify the world price[187] of the commodity.
2. The calculation of import parity prices[188] is conducted with the F.O.B (free on board) price at the border of the reference country[189]. However, the PAM elements are

[184] The SP to US$ exchange rate of private transaction is applied as the nominal exchange rate valued at 50 SP as a result of the increasing integration of the former multiple exchange rate regime. Given the relative stability of this rate in the past years, it is eventually assumed to take the same rate as the real exchange rate (Social price).

[185] The parity point is being the point where local supply of the main output competes with the imported one or its substitute. This point is allocated at farm gate or the processing factory gate.

[186] They are called: import parity prices, or sometimes, border price equivalents.

[187] Information of the world price is taken from the FAOSTAT database and the product parity point, the place where to compare the local price with world price, was at company packing gate.

estimated in Syrian pounds. Therefore, the exchange rate has been applied in order to obtain the F.O.B in Syrian pound, and then, the government subsidy has been added after deduction of the taxes and the imposed fees.

3. To obtain the C.I.F[190] price, insurance and freight are added C.I.F to move it from the point of export to the harbor of the importing country.
4. On the other hand, the calculation of export parity prices[191] is conducted with the C.I.F price at the border of the reference country, which is usually considered as a major importer.
5. In order to obtain the F.O.B price to move it from the point of import to the harbor of the exporting country, insurance and freight are subtracted.

After computing the total cost per ton of citrus for export at the private (market) price and in order to complete the construction of the citrus fruit PAM, the previous method has been applied to estimate the total cost per ton of citrus for export at the social (economic) price (Table 29).

Table 29: Total cost at social price for producing one ton of exported citrus fruit; (Unit: SP/Ton)

		The distribution of disaggregation coefficients of processing cost (per ton)	
		Tradable Inputs (TI)	Domestic Factors (DF)
Total cost per ton of citrus	8926	3097.6	5828.4

Source: Own calculation based on SMAAR data base.

3.2.5 The Policy Analysis Matrix (PAM) for citrus fruit[192]

As mentioned in the sections 3.2 and 3.2.1 the Policy analysis matrix (PAM) is an instrument by which policy makers are able to find out which specific part of an agricultural sector has the best advantage in relation to international competitors and assesses its potential

[188] That relies on the use of international market sources.

[189] Usually considered as a major exporter.

[190] C.I.F means: cost, insurance, and freight.

[191] That relies on the use of international market sources.

[192] The aggregate macro-price used in the computation of the citrus fruit PAM is derived from the information collected from various primary and secondary data sources, during 2006-2009, with the assistance of policy analysts from the Ministry of Agriculture and Ministry of Finance in Syria.

comparative advantage. Whereas comparative advantage allows to identify the economic profitability of an activity and to estimate revenue and cost by using an independent way of all market distortions, either subsidization or taxation; PAM can also be applied in a logical manner for the entire commodity chain (producers, processors, traders), not only at farm level, to identify the level of profitability. In other words, it gives the opportunity of making an interesting comparison among a number of commodities or production systems to determine which one has more profitability and the strongest comparative advantage.

Comparative advantage measures the changes in the world price of tradable outputs and inputs, opportunity costs of domestic factors of production (labor, capital, land), and the production technologies used in farming and marketing. These three economic parameters constitute the major determinates of the social profitability and comparative advantage.

Table 30 illustrates the final and complete construction of the PAM of exported citrus fruit to foreign markets. It presents the aggregated value of revenue, total costs of tradable inputs and domestic factors, and the profit for the whole commodity chain. The distribution ratios of the total costs emphasize that approximately 65% of the total costs of citrus production, are based on domestic factors; either these costs have been estimated at private price or at social price.

Table 30: The Syrian citrus Policy Analysis Matrix (PAM); (Unit: SP/Ton)

	Revenue	Costs		Profit
		Tradable Inputs (TI)	Domestic Factors (DF)	
Private prices	(A) 19500	(B) 3107.1	I 5852.9	(D) 10540
Social prices	I 18567.5	(F) 3097.6	(G) 5828.4	(H) 9641.5
Effects of divergences and efficient policy (Divergence)	(I) 932.5	(J) 9.5	(K) 24.5	(L) 898.5

Source: Own calculation based on SMAAR data base.

In accordance to Table 23, D measures the private profitability and is defined as the difference between total revenues (A) and costs of production (B+C) at private prices. This private profitability demonstrates the competitiveness of the commodity under current policies at actual market prices. When (D) value is positive, the private profits of exported fresh citrus fruits are positive. This indicates the competitiveness of the sector. Therefore, in the future, the number of farms, farmers, processors, and traders working in fresh citrus will increase.

H measures the social profitability and is defined as the difference between total revenues I and costs of production (F+G) at social prices. This social profitability demonstrates the comparative advantage of the fresh citrus fruits under opportunity costs. When (H) value is positive, then the exported fresh citrus fruits have positive social profit. This means that this sector uses the scarce resources efficiently and has a comparative advantage in producing fresh citrus fruit.

The values in the third row of the PAM refer to the total effect of policy and other distortions (taxes, subsidy). The third row contains the differences between the values in the first and second row. The differences between private and social values are considered as transfer. For example, when (I) value is positive, then the value of revenue at market price (A) exceeds the value of revenue at social price I. As a result, there is a transfer from the economy to the fresh citrus fruit sector by (I) value.

J illustrates the divergence of tradable inputs. Principally, the value of this divergence is a result of exchange rate distortion effect, either overvaluation or devaluation, and duties. For example, when (J) is positive, that means there is a transfer from citrus sector to the rest of the economy by J value, and the value of tradable inputs at private prices (B) is higher than that in social price (F). This means that there is a tax imposed on tradable imports, and there is devaluation of the SP (making imports more expensive).

When (K) value is positive, that means that the cost of domestic factors to produce one unit of the main output at private prices I is higher than social cost (G). This means that there are difficulties to access the international market for this activity and there is not a net transfer by K from the economy to support this sector. When (L) value is positive, that means there is a net transfer from the economy to the citrus sector by L value.

Table 30 shows the following results:

1. D>0: That means there is a private profit of this system by (D) value and this system is competitive.
2. H>0: That means there is a social profit of this system by (H) value and this system has comparative advantage.
3. I>0: That means there is a transfer from the economy to the fresh citrus fruit sector by (I) value, no tax on producer, no subsidy to consumer by the value of (I), and the citrus sector is supported.

4. J>0: That means there is a tax on tradable inputs by the value of (J) and there are transfers from citrus sector to the economy.
5. K>0: That means there is no subsidy for domestic factors by the value of (K).
6. L>0: That means there are net transfers by (L) value from the economy to this sector.

3.2.6 Policy analysis indicators of fresh citrus fruit to foreign markets

According to section (3.2.2), PAM provides a range of indicators for assessing the efficiency and the comparative advantage of a system. Table 31 presents the results of computing the policy analysis indicators of exported citrus fruit to the foreign markets.

1. Domestic Resource Cost Ratio (DRC = 0.376 < 1): That means Syria has comparative advantage with packaging fresh citrus fruits to foreign markets.
2. Social Benefit Cost Ratio (SBC = 0.48 < 1): That means Syria has comparative advantage in producing and exporting citrus fruits.
3. Financial Profitability (FP = D = 10540): FP is positive. This illustrates the value of the profit generated by packaging fresh citrus fruits to foreign markets at private price which means that the production system of citrus is competitive.
4. Social Profitability (SP = H = 9641.5): SP is positive. This illustrates the value of the profit generated by packaging fresh citrus fruits to foreign markets at social price which means that the production system of citrus has comparative advantage.
5. Financial Cost Benefit Ratio (FCB = 0.35 < 1): This indicates the competitiveness of the citrus production system.
6. Transfers (L = 898.5): L has a positive value. That means there is a net transfer from the economy to the citrus production sector.
7. Nominal Protection Coefficient on Tradable Outputs[193] (NPCO = 1.05 > 1): That shows that policies are increasing the market price to a level 5% higher than the world price. In other words, the system benefits from protection since it gets higher revenues at private prices than it would get at social prices.

[193] This indicator refers to the degree of output transfer.

Table 31: Policy analysis indicators of fresh citrus fruit to foreign markets

Indicators	Equations	Results
1. Domestic Resource Cost Ratio (DRC)	[DRC = G/(E-F)]	0.376
2. Social Benefit Cost Ratio (SBC)	[SCB = (F + G)/E]	0.48
3. Financial Profitability (FP)	[D = A-B-C]	10540
4. Social Profitability (SP)	[H = E-F-G]	9641.5
5. Financial Cost Benefit ratio (FCB)	[FCB = C/(A-B)]	0.35
6. Transfers (L)	[L = I + J + K]	898.5
7. Nominal Protection Coefficient on Tradable Outputs (NPCO)	[A / E]	1.05
8. Nominal Protection Coefficient on Tradable Inputs (NPCI)	[B / F]	1.003
9. Effective Protection Coefficient (EPC)	[(A – B) / (E – F)]	1.06
10. Profitability Coefficient (PC)	[D / H]	1.09
11. Producers Subsidy Ratio (PSR)	[L / E]	0.048
12. Equivalent. Producer Subsidy (EPS)	[L / A]	0.046

Source: own table, based on Table 24, Table 30, and Monke and Pearson, 1989.

8. Nominal Protection Coefficient on Tradable Inputs[194] (NPCI = 1.003 > 1): It indicates that policies are increasing input costs and the average market prices for these inputs are only 0.3% higher than world price.
9. Effective Protection Coefficient (EPC = 1.06 > 1): It means that there is a protection for the citrus production system (taxation).
10. Profitability Coefficient (PC = 1.09 > 1): That means there is a net transfer from the economy to this system.
11. Producers Subsidy Ratio (PSR = 0.048): The positive value means that there is a net transfer from the economy to this system and the producers are subsidized.
12. Equivalent Producer Subsidy (EPS = 0.046): it has a positive value which means that the producers are subsidized or the consumers are taxed.

Finally, two important results can be concluded from the previous policy analysis indicators of fresh citrus fruit:

1. In Syria, the system of citrus fruits production has comparative advantage.
2. In Syria, the system of citrus fruits production is competitive.

3.2.7 Transition from comparative advantage toward competitive advantage

Under the recent global economic changes which coincided with the transmission of nations from closed economies to open economies[195], by removing the barriers of global trade and the flow of capital, and the emergence of competition between them, in order to find new markets for their products or/and increase their exports share on the world market (Gans *et al.*, 2011). And in the light of the previous findings which showed that the Syrian citrus sector has a comparative advantage, it becomes very necessary to identify the possibility of converting this comparative advantage of citrus fruits production into competitive advantage through which the Syrian citrus products are able to enter foreign markets under conditions of fierce international competition.

[194] This indicator shows the degree of tradable input transfer.

[195] A closed economy is an economy which does not interact with other economies, in contrast to the open economy, which interacts with other economies by buying and selling goods and services in world product markets; and buying and selling financial assets in world financial markets. In other words, closed economy is an economy in which no activity is conducted with outside economies and it is self-sufficient, meaning that no imports are brought in and no exports are sent out. A closed economy is the opposite of an open economy, in which a country will conduct trade with outside regions.

In 1993 the OECD defined the perfect competition in a well-defined market by four conditions:

1. Within this market there are such a large number of buyers and sellers that none can individually affect the market price which means that the demand curve is perfectly elastic.
2. In the long run, there are no barriers to entry and exit, meaning that resources are mobile.
3. All buyers and sellers (market participants) must have full access to the knowledge relevant to their production and consumption decisions.
4. In this market the product should be homogenous.

Accordingly, the market is perfectly competitive when these four conditions are fulfilled in any well-defined market; and the economy is perfectly competitive when they are fulfilled in all markets. Based on this definition, the United States of America considered competitiveness one of the major indicators of the national security and associated with it directly (OECD, 1993).

The concept of competitiveness varies according to companies, economic sectors, and nations. Implying that, the competitiveness at the level of an enterprise which is seeking to gain shares in international markets, differs from the competitive group of companies operating in a particular industry. These in turn differ from a competitive nation seeking to achieve a high and sustainable rate of per capita income. Also, the concept of international competitiveness is linked to the economic policy of a country and the relationship between the domestic economy and the global economy, where the exchange rate[196] is considered the most important linking tool between the domestic economy and the global economy.

For a nation it is important to maintain cost levels which are consistent with the costs of other producers in order to remain at the circuit of competition. International competitiveness is also related to the level of production costs.

The concept of competitiveness uses different, unspecified, and widespread standards. So it can be defined, in general, as how can the nation use measures and procedures which may

[196] The rise of exchange rate leads to raise the price of foreign commodities in domestic economy, and hence, makes them less competitive within it; in contrast, it raises the competitiveness of domestic market in global markets.

lead to distinguish it from competitors and achieve superiority. Consequently, competitiveness of commodity products is a result of several factors, interrelated and differentiated in their patterns and effects. These factors and determinants can be summarized in the following points (Krugman, 1994; Kennedy *et al.*, 1997; Alcala, 2009):

1. *Production cost*[197]*:* This cost and its structure are the main determinant of competitiveness due to their association with commodity product price. It can be identified according to price of the input of raw materials, cost of labor and its availability, level of training, rehabilitation, and assimilation of modern technology as well as the cost of other input like, electricity, water, fuel etc.
2. *Quality:* Competitiveness of a certain nation is enhanced by raising and improving the quality of its products through paying attention to input and labor quality.
3. *The role of government:* Government plays a significant role in increasing the competitiveness of goods through the provision of infrastructure services, which support commodity sectors, and adoption of economic policies and administrative procedures which enhance competitiveness.

The main feature of the economic activities, at present, is the world competition. As the traditional barriers[198] of goods and services flow are fading, the technical barriers which related to quality standards are increasing, resulting in emergence of new competitors characterized by high degree of skill and strength. It is also noticeable through many instances over the world that the traditional sources of comparative advantage, which is represented by resources and available natural endowments, are no longer important as a tool for the development of a strong competitive economy. Therefore, the interest in the competitive advantage principle as an alternative reference model for development has started. Competition is associated with the will of a nation which seeks to increase the available resources productivity, whether they are human or physical.

Whilst comparative advantage helps countries in introducing their goods into international markets, by relying on the support and protection offered by governments, the protocols and

[197] There is an inverse relationship between competitiveness and production cost, implying that the competitiveness of a certain commodity will increase as much as the state is able to reduce the production cost of this commodity.

[198] Such as customs duties and quotas.

trade agreements which are signed with foreign parties, and relying also on the use of low quality inputs in order to reduce production cost and thus to produce competing goods in the price terms; making them unable to withstand and compete within domestic and global markets in the terms of quality. The competitive advantage that would focus on meeting consumer needs in terms of quality and thus the use of developed and trained production factors, and in spite of its impact on the cost increase in the short run, but it, at the same time, helps products to break into developed and rich markets. For all previous reasons, Syria has to exploit the comparative advantage of citrus fruit sector and upgrade it to the level of competition.

3.2.8 Indicators of international competitiveness

The Canadian Agri-Food Competitiveness Task Force defined competitiveness as: "*The sustained ability to profitably gain or maintain market share*" (Martin and Stiefelmeyer, 2001). This definition was an attempt to catch the multiple dimensions of the competitiveness concept. However, its application remained, narrowly, focusing on the trends which based on two indicators through the years, the trade net balance and the value added generated.

According to Van Rooyen *et al*., (19999, there are various and associated methods which were developed and used by researchers to assess competitiveness, such as:

1. Measures based on market share[199].
2. The study of competition which originated and developed by Porter in his books about the competitive advantage of nations in 1990 and 1998.
3. The competitiveness indicators as originally developed by Balassa[200] (1977, 1986).
4. The cost based competitiveness or the concept of comparative advantage which was presented by Monke and Pearson[201] in 1989.

In 2007, Alvarez-Coque[202] subdivided the indicators which are used to assess the competitiveness of a nation in the international trade markets into two major approaches:

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[199] For instance, the Boston Consulting Group Matrix.

[200] It also depends on the market share and includes the concept of *Revealed Comparative Advantage* (RCA).

[201] See section 3.2.1.

[202] Professor J. M. Garcia Alvarez-Coque, Thematic Advisor of NAPC' trade policies division, presented a seminar on 'Competitiveness of Agricultural Exports'. This seminar was organized on 1 August 2007 at the NAPC premises in Damascus. Within the activities of Agricultural Policy Forum series of the National Agricultural Policy Center (NAPC) of the Syrian Ministry of Agriculture and Agrarian Reform and with the

1. *The Standard Approach*: This approach focuses on the outcomes, results, and the revealed performance achieved by a country in international trade. Namely, it is used to asses a country's competitiveness through its exporting ability sector by sector. Moreover, the standard approach is useful to asses a short-term success generated of temporary circumstances. Accordingly, the indicators used in this method are:

   - per capita exports,
   - share in world markets, and
   - various measures of product and market diversification.

2. *The Structural (Systemic) Approach*: This approach focuses on assessing the impact of each factor not only on the competitiveness of a given sector but also of the nation. Therefore, many affecting variables are involved like services, products, territories, and their people. Such structural factors would allow nations to be competitive in a globalized world. In contrast to the standard approach, this approach is useful for the competitiveness of the agricultural sector over the long-term and allows drawing strategies for success. However, to apply the systemic approach the agricultural sector has to be considered as a separated part from the rest of the economy. Also, it is not enough to achieve high efficiency in the long-term by increasing the productivity of an agricultural product, but it is also important to analyze all factors which are surrounding this product and facilitating the process of improving its quality and then the sustainability of its marketing.

Ban (2010) has classified the main indexes, which are used to identify if a product has competitiveness within the international markets or not, into two categories by relying on macroeconomic and microeconomic principles:

1. The first indicator category which depends on macroeconomic principles and includes the following groups elements:
   - Trade balance indicators.
   - Indicators of International Economic Openness.
   - Indicators of Geographic Concentration / Dispersion of Relative Import and Export Price of Goods and Unit labor costs based Competitiveness.
   - Intra-industry Trade Indicators, etc.

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support of the FAO Project GCP/SYR/006/ITA. URL: http://www.napcsyr.org/dwnld-files/newsletter/11th_issue_en.pdf.

2. The second indicator category which depends on microeconomic principles and includes the following groups elements:

- Products' Trade Concentration/Dispersion indexes.
- Revealed Comparative Advantage (RCA) indexes, as shown by: Balassa (1965), Michaely (1984), Lafay (1992), and Vollrath (1991).
- The Model of Dynamic Competitive Advantage[203].
- Competitive Advantage Conformation by using Michael Porter's cluster model.

Due to the lack of information the analysis of the Syrian citrus sector competitiveness will be restricted to two indicators, the *Standardized Trade Balance (STB) and the Revealed Comparative Advantage (RCA)*, by using secondary data of the FAO, SMAAR, NAPC, CBS, Eurostat, and Euro-monitor databases. Nevertheless, it would be very beneficial to illustrate the conceptual principle of some methods and other benchmarks which are used in analyzing the competitiveness such as the BCG matrix and Porter's diamond model.

3.2.8.1 The Boston Consulting Group Matrix

The Boston Consulting Group was established in the 1960s as a specialized company to provide strategic marketing advice. This group developed a matrix[204] that formed the most dynamic assessment of competiveness that based on world market shares. This matrix categorized the given product on X/Y graph by comparing the market growth rate (cash usage) to the relative market share in a country (Figure 17). Each product can be classified along four groups (Le Marinel, 2004; Kohlert, 2006; Holzmann, 2008):

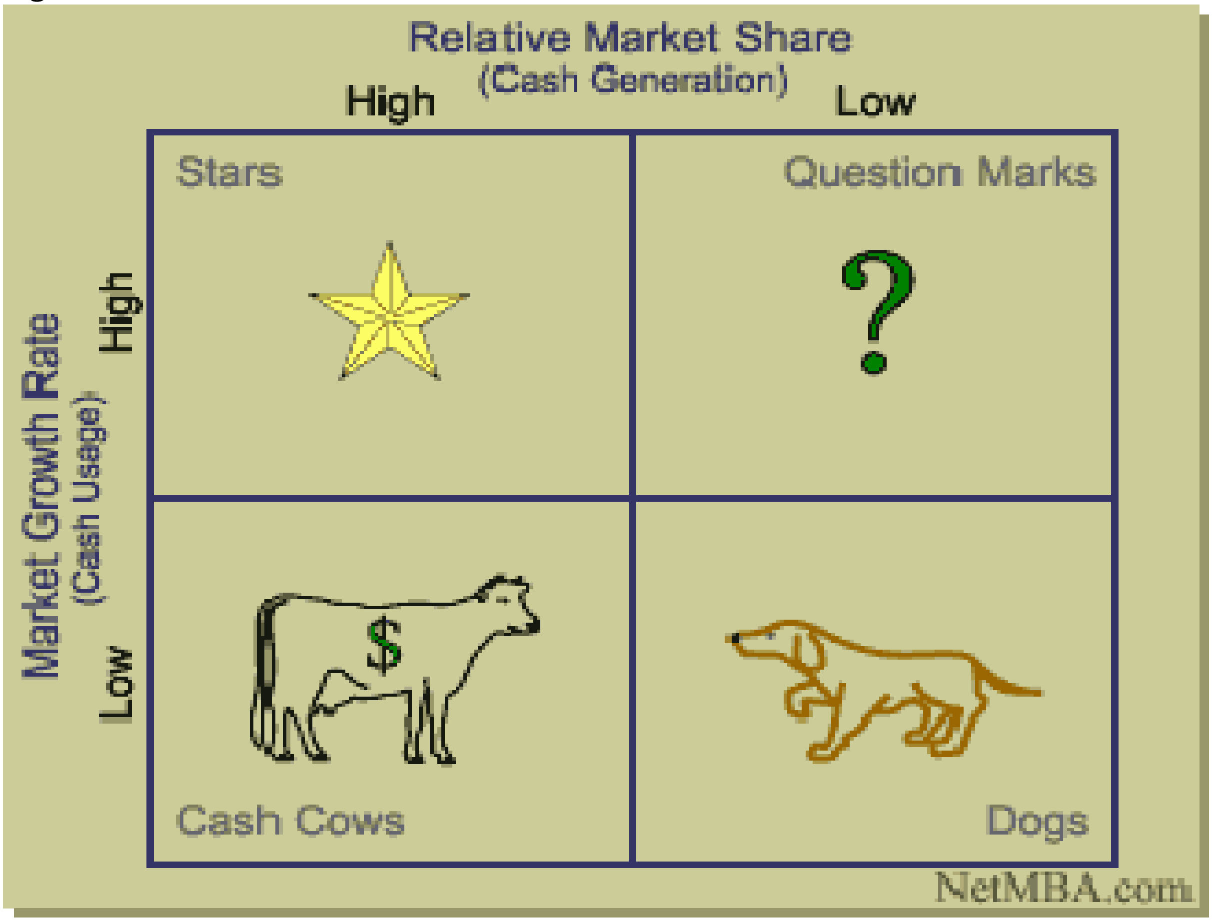
1. 'Question Mark' products: This group is characterized by a high market growth and low share of the world market, indicating that the product has possibility to expand but with a high level of uncertainty.
2. 'Star' products: This group contains products for which world market growth is high and market share expands rapidly. In other words, they are clearly products for which the selected country presents a competitive advantage.

[203] This model is similar to the BCG matrix. often used in the marketing research. It consists of a chart with four quadrants. The annual percent variation of national export supply is represented by x-coordinate, while the annual international demand variation is viewed on the y-coordinate.

[204] This perspective was called also as 'The Product Portfolio'; for more information about BCG, see the BCG website: http://www.bcg.com/about_bcg/history/history_1968.aspx.

3. ‘Cash Cow’ products: It contains products for which the country’s market share growth is high but the world market expansion is low. This implies that the favorable position of the country on this market does not mean that there is a perspective for long term expansion.
4. ‘Dog’ products: This group contains products for which the country’s market share is stagnating or even declining in a market that is globally shrinking. This means that these products do not offer any perspectives in terms of market share expansion.

Figure 17: BCG Growth-Share Matrix

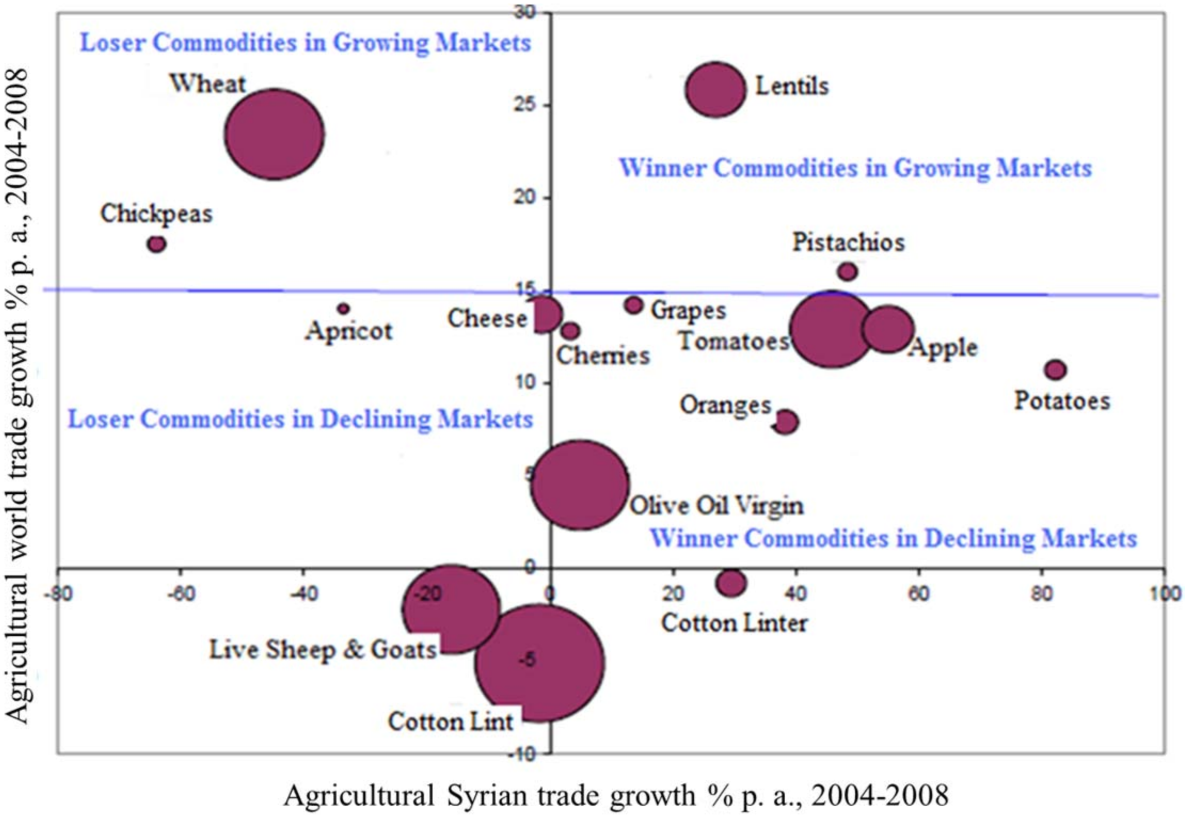


Source: Elaborated from: http://www.netmba.com/strategy/matrix/bcg/

In the term of market share, the assessing of advantage is will be easy to carry out as far as the required data are accessible. However, it only provides a snapshot of the relative position of a country in a given market or economic sector. It also gives only a limited insight into the factors that affect the observed position or trends of the sector’s competitiveness. Nevertheless, they can be used as preliminary investigations of the issue but should be combined with other tools to achieve a better understanding of the problem and a clear identification of the factors that determines competitiveness (Lancon, 2011).

Based on the BCG matrix, the NAPC report about Syrian Agricultural Trade illustrated in 2010 the performance of Syrian leading exported products during 2004-2008 (Figure 18). The laying trade map showed the average growth of the international agricultural trade for the same period, (horizontal blue line), which was in the range of 14.9%.

Figure 18: Syrian agricultural trade map during 2004-2008



Source: Elaborated from (NAPC, 2010)

With respect to the export value[205] of the considered agricultural products against the annual growth of selected Syrian agricultural exports share in the world markets[206], and the annual growth of the international agricultural exports for the same selected commodities during the same period[207] the map is divided into four quadrants. Each quadrant contains different commodities and different characteristics as follows:

[205] The size of bubbles refers to the export value.

[206] Horizontal axis in the map represents the annual growth of selected Syrian agricultural exports share in the world markets.

[207] Vertical axis in the map represents the annual growth of the international agricultural exports or world demand on the same selected commodities during the same period.

1. Upper-right quadrant: It contains the superior commodities that achieved a significant growth above the average of world trade growth. This led to an increase of their share of the world's imports.

   During the reference period, the exports of these products proved to be internationally competitive. However, due to the fact that these products are successful in the international markets[208], the risk that faces the efforts[209] exerted to promote the trade of such products is in the minimum level. As shown in Figure 18, the number of Syrian agricultural products comprising this category decreased during the period 2004-2008 compared with 2003-2007 (NAPC, 2009). Lentils and pistachios joined this group. Contrary to that apple and olive oil left the group and joined the group of winner commodities in the declining markets and wheat moved to the group of underachiever commodities.

2. Upper-left quadrant: It contains the underachiever commodities that represent particular challenges for trade promotion efforts, either because they have not demonstrated the ability to join the positive trend of their international markets, or because they declined or grew at lower pace compared to world trade. This situation results in a loss of the Syrian share of international markets, which requires a definition and removal of the challenges and constraints facing these products that impede dynamic expansion of exports. Figure 18 indicates that wheat and chickpeas joined this category during 2004-2008.

3. Lower-left quadrant: It contains loser commodities in declining markets. These products are not promising, as the world imports of them are either stagnant or declining[210], accompanied by a decline of the Syrian share in the world market. The efforts exerted for trade promotion of them are facing serious constraints because of the need to adopt an integrated promotion approach that takes into account the bottlenecks in supply and demand. According to Figure 18, this group of products includes cotton lint, apricot, cheese, and live sheep and goats (NAPC, 2009; NAPC, 2010).

[208] This fact can be used as a reference points.

[209] The promotion efforts should aim at enhancing the supply capacity of these products.

[210] This decline can be justified as a result of production decrease during the studied years or due to processing of the products instead of exporting them as raw materials (e.g. cotton).

4. Lower-right quadrant: It contains winner commodities in declining markets which are generally characterized by growing shares of Syrian exports in the world markets that are either declining or growing below the average of the global trade growth. Oranges, grapes, cherries, tomatoes, apples, potatoes, and olive oil are under this category with regard to Syria. From the perspective of trade promotion, export strategies to niche-markets are needed to protect the positive trade performance of such products from the total decline of these markets. This strategy can be also applied to the Syrian citrus production for export, (NAPC, 2010).

In other words, this map, through its horizontal and vertical axis, clarifies the changes which took place in the agricultural exports both on the domestic and the international levels.

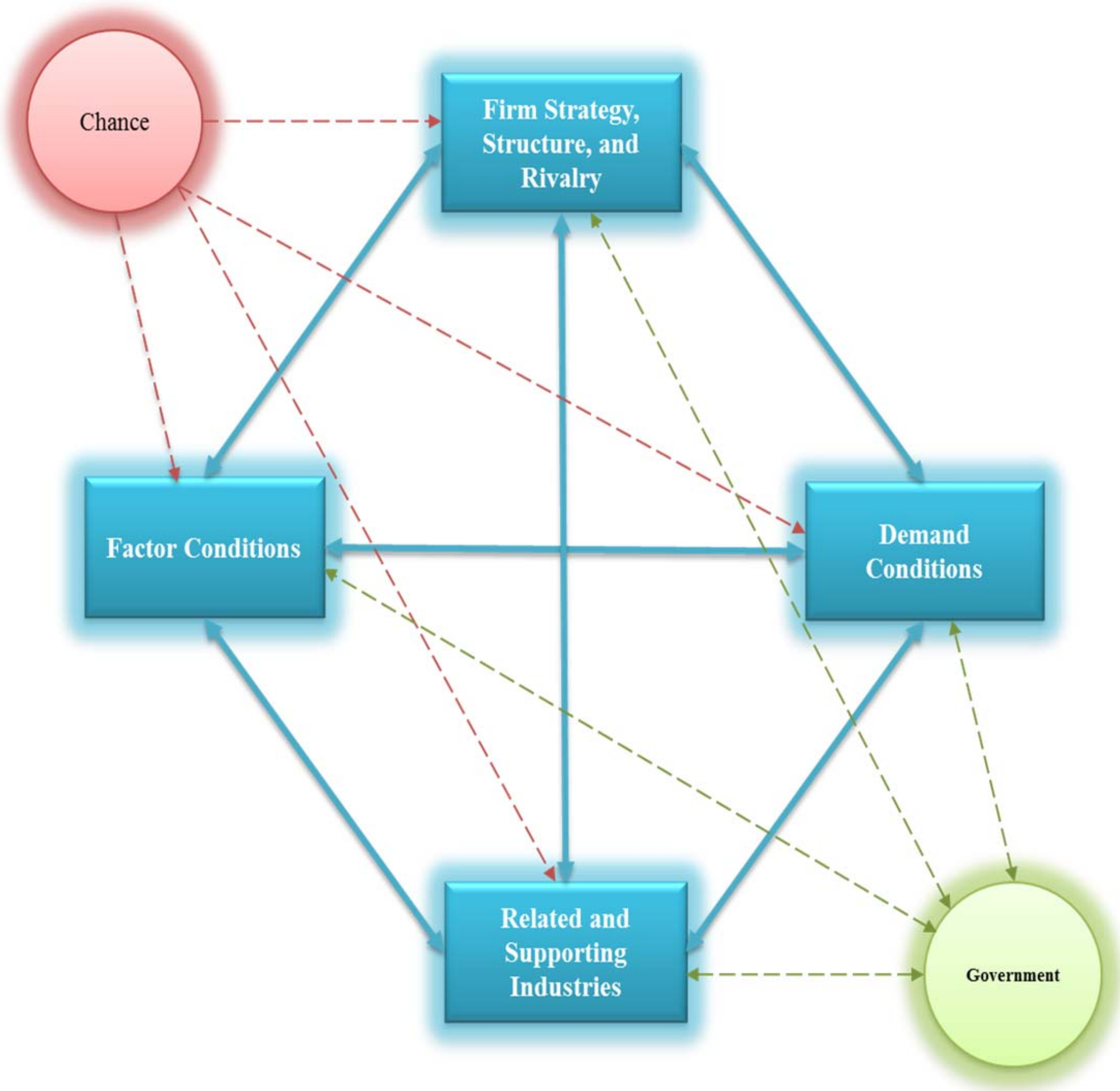
3.2.8.2 Porter's diamond framework

In order to explain the various attributes of competitiveness, Porter has proposed in 1990 an analytical framework to understand how a set of factors can interact to establish an industry or a competitive economic sector. This framework is a simple perspective. It consists of four inter-linked growth determinants incorporated into Porter's diamond (Figure19) (Porter, 1990; Porter, 1998; Van Rooyen, 1999; Jin and Moon, 2006; Smit, 2010; Lancon 2011):

1. Factor conditions: This determinant refers to the nation's position in factors of production which is needed to compete in a given industry. These factors can be grouped into a number of broad categories as follows: human resources, physical resources, knowledge resources, capital resources, and infrastructure.
   In order to understand the enduring role of factors in competitive advantage, Porter divided factor conditions into basic and advanced factors. Basic factors include unskilled labor, raw materials, climatic conditions, and water resources. These basic factors are inherited and require little or no new investment to be used during the production process. On the contrary, advanced factors are created and upgraded through reinvestment and innovation to specialized factors. These factors form the basis for a sustainable competitive advantage of a nation. In other words, basic and advanced factors are related with the concept of productivity and financial profitability, to a certain extent.
2. Demand conditions: According to Porter, demand conditions refer to the nature of home-market demand for an industry's product or service. He viewed this determinant in terms of the home market size and sophisticated consumer expectations. If the home

demand size is large, companies will invest to get economies of scale. Also, in countries where the domestic consumers are the most sophisticated and demanding over the world, firms are forced to meet high standards, to upgrade, and to respond to tough challenges. Nevertheless, Porter identified a broad variety of reasons for remarkably demanding needs such as: social norms, distribution channels, and national passions.

Figure 19: Porter's diamond model



Source: (Porter, 1990; Porter, 1998)

3. Related and supporting industries: Porter emphasized that the presence of suppliers and related industries which are internationally competitive provides benefits like innovation, upgrading, information flow, and shared technology development.

Implying that, if the nation has a competitive advantage in a number of related industries, the national success in an industry is especially potential.

4. Firm strategy, structure and rivalry: This last determinant refers to the conditions in the nation governing how companies are created, organized, and managed, as well as the nature of domestic rivalry. Porter argued that nations tend to succeed in industries where the management practices and types of organization favored by the nation are appropriate to the industries' sources of competitive advantage.

In 1998, Porter added two external attributes to the previous determinants, chance and government. Government can affect each of the four attributes either positively or negatively and play a vital role. The chance events[211] are considered as incidents and play a little role with conditions in a nation and are often largely outside the power of firms (and often the national government) to influence.

Due to its analytical power and comprehensiveness, Porter's Diamond became a standard reference for evaluating the competitiveness of productive systems. But it must be noted that this analytical framework does not offer a clear benchmark to measure the competitiveness as it focuses on the interaction between several collections of variables that determine competitiveness. As a part of the systematic trend of Porter the competitiveness is not a static outcome but a practice (Lancon, 2011).

Porter's model is applied to all players through the supply chain of an economic sector and allows evaluating and analyzing its structure in order to indicate the strengths and weaknesses along the whole chain. However, the crucial success factors can also determine which actors in a chain require special attention in order to develop and sustain competitive advantage as successfully as possible in the years to come (Van Rooyen *et al*., 1999).

Respecting agricultural sector in Syria, Alvarez-Coque[212] contended that the production process depends essentially on the availability of labor and natural resources which allow the production of good products. However, this is not enough, because the supporting industries and demand conditions are required. This includes the need to access the EU markets as well as to develop the domestic market for different agricultural products. Therefore, the role of

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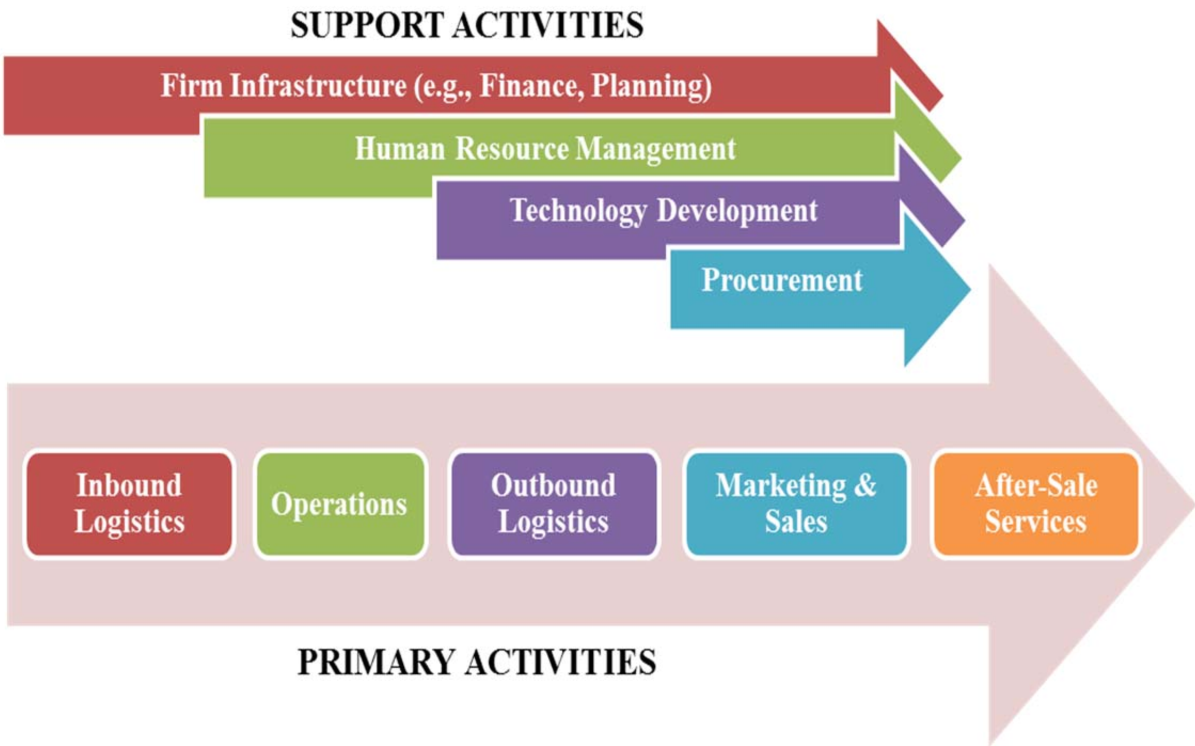
[211] Some examples of chance events are: wars, political decisions by foreign governments, large increase in demand, shifts in world financial markets and exchange rates, discontinuity of technology and input demand.

[212] *Op. cit.,* see section 3.2.8.

government is very important to intervene for providing appropriate competitive conditions through the support of all aspects of Porter's Diamond. Thus, government has to act as a director of competition, enhance innovation and stimulate demand. Accordingly, the problem is not confined only to the achievement of efficiency in the agricultural sector, but in working to increase the overall efficiency for agriculture and nation together. Since nation efficiency is a prerequisite for agricultural growth, the coordination between them is absolutely necessary for the development of both.

In 1998, Porter argued that competitive advantage arises out of the way in which companies organize and perform distinct activities. These activities can be divided into two categories either primary or support activities that constitute the value chain (Figure 20).

Figure 20: Porter's value chain



Source: Own figure elaborated from (Porter, 1998)

As shown in Figure (20), Porter's value chain is an interdependent system of activities, connected by linkages. When the way in which one activity is accomplished influences the cost or efficiency of other activities then the linkages will grow out. Consequently there are two basic possibilities to improve efficiency, either through increasing yield by optimizing the market performance[213] to meet consumers' needs and commodity competitive emplacement; or reduction of costs, which can be achieved throughout the whole system of input, transformation and output factors. Also, waste must be avoided to maintain a high efficiency, tough cost control is imperative, and output costs are marketing expenditures (e.g. advertising, distribution, time), which may only be as high as necessary.

The primary activities are:

1. Inbound logistics: They involve the relationships with suppliers and include all the needed activities to receive, store, and disseminate inputs.
2. Operations: They refer to all required activities to convert inputs into outputs.
3. Outbound logistics: They include all the needed activities to collect, store, and distribute the output.
4. Marketing and sales: They are the activities that inform buyers about products, induce buyers to purchase them, and facilitate their purchase.
5. Service: It includes all the required activities to keep the product or service working effectively for the buyer after it is sold and delivered.

The secondary activities are:

1. Procurement: It includes the acquisition of inputs, or resources, for the firm.
2. Human resource management: It includes all activities involved in recruiting, hiring, training, developing, compensating and (if necessary) dismissing or laying off personnel.
3. Technological development: It pertains to the equipment, hardware, software, procedures and technical knowledge brought to bear in the firm's transformation of inputs into outputs.
4. Infrastructure: It benefits the company's requirements and connects its different sections together; it consists of departments such as accounting, legal, finance, planning, public affairs, government relations, quality assurance, and general management.

Porter extended the value chain approach for competing in a particular economic sector into a larger stream of activities called the value system (Figure 21).

[213] All marketing activities must be coordinated. This refers to external and to internal marketing. This approach will automatically lead to a company culture of customer-orientation.

Figure 21: Porter's value system

Source: Own figure elaborated from (Porter, 1998)

A value system consists of:

1. Suppliers value chains: Suppliers provide inputs such as raw materials, components, machinery, and purchased services.
2. Firm value chain: It produces the commodities which are marketed by channel value chains.
3. Retailers value chains: They refer to the value chains of distribution or retailing channels which are responsible for delivering the ultimate item to the final buyer.
4. Consumers value chains: They represent the ultimate buyers of the firms' products.

Identifying the competitiveness of agricultural products leads to concentrate on the value chain approach which takes into account the different stages of processes, starting with raw materials and ending with the delivered product. Usually, producing industrial commodities requires a very complex process accompanied by many ingredients; each one of them does not dominate the whole input chain. The agro-food production processes are characterized by a lower number of intermediate goods combined into the process. This implies that the value chain of an agricultural commodity is the main used input at each stage of manufacturing operations. For instance, although citrus fruit is one of the agricultural product value chains which can disappear with the increase of the complexity of the industrial ready-to-eat food, it remains the major input for each operation that forms the entire system (Hosni and Lancon, 2011; Karkout and Lancon, 2011; Al-Hamwi and Lancon, 2011). As a result, the proposed methodology to analyze the competitiveness of any agricultural sector combines a value chain approach with the determinants of Porter's model.

3.2.8.3 Standardized Trade Balance (STB)

The STB of a product is one of the commercial indicators of competitiveness which provides an overview about the agricultural product share in the international markets, the distribution of its surplus, and its deficit among various countries. According to Sassi (2003) and Carri and Saasi (2007), STB is given by:

$$STB = \frac{E_{ij} - I_{ij}}{E_{ij} + I_{ij}}$$

Where:

(E_{ij}): Quantity of export

(I_{ij}): Quantity of export

This indicator is used as a guide of specialty or non-specialty for a country in exporting a particular product. When STB is increasing, the competition in global market will be improved, and vice versa. Consequently, product share in the market is considered an indicator to measure its competitiveness:

1. When the quantity of imported product (I_{ij}) goes down and approaches zero, the value of STB indicator will increase and approach one. Thus, the comparative advantage of export will be considered complete when STB = 1.
2. Conversely, the value of STB will become negative when the quantity of exported product E_{ij} is less than imported quantities.
3. STB = -1 when there is no export of the studied product.

To calculate the competitive index of citrus in Syria during (2000-2009), the previous equation is applied as follows in (Table 32):

$$STB_{CS} = \frac{E_{CS} - I_{CS}}{E_{CS} + I_{CS}}$$

E_{CS} = Quantity of exported citrus in Syria

I_{CS} = Quantity of imported citrus in Syria

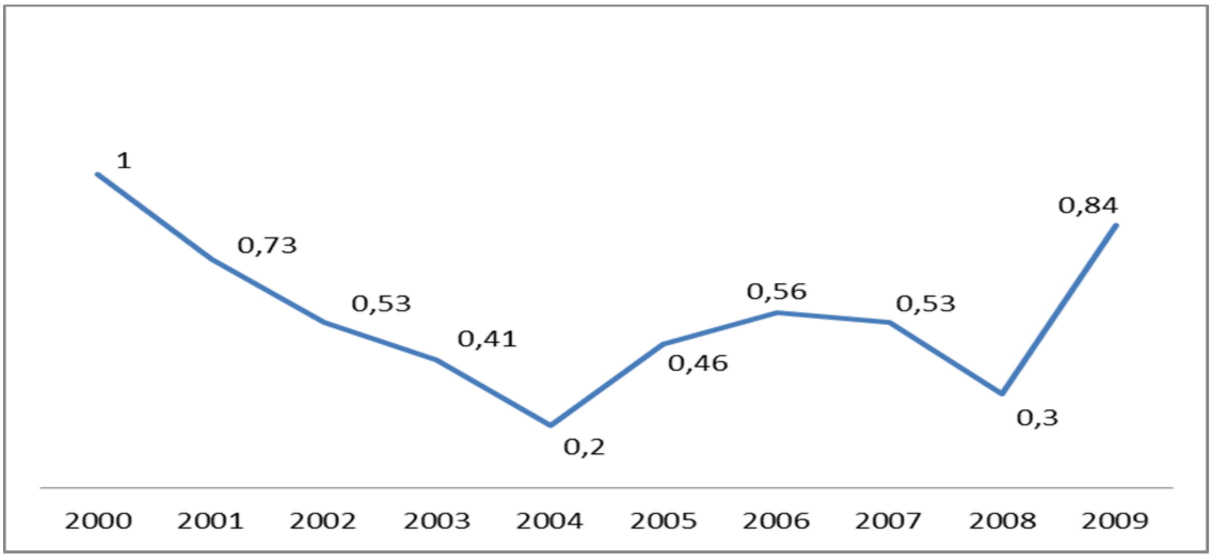
Table 32: Standard Trade Balance of citrus in Syria during 2000-2009; (Unit: per 1000 M. T.)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
E_{CS}	39	45	29	28.9	27.8	53.5	75	81	85	269.8
I_{CS}	0	7	9	12	18.6	19.6	21	25	46	38.6
$E_{CS} - I_{CS}$	39	38	20	16.9	9.2	33.9	54	56	39	258.2
$E_{CS} + I_{CS}$	39	52	38	40.9	46.4	73.1	96	106	131	308.4
STB_{CS}	1	0.73	0.53	0.41	0.2	0.46	0.56	0.53	0.3	0.84

Source: Own calculation based on (AASA, 2010)

It is noticeable from Table 32 that Syrian citrus has maintained competitive advantage during 2000-2009. While competitive advantage was complete in 2000 (STB_{CS} = 1), it decreased gradually until 2004 (STB_{CS} = 0.2), and then it returned to increase until 2009 (Figure 22).

Figure 22: Standard Trade Balance of citrus in Syria during 2000-2009



Source: Own figure based on Table 32

3.2.8.4 Revealed Comparative Advantage (RCA)

There are several analytical frameworks which use the market share as an indicator of competitiveness[214]. Accordingly, the concept of *Revealed Comparative Advantage (RCA),* pioneered by Bela Balassa (1965, 1977, 1979 and 1986) is widely used in practice to

[214] They are usually assessed at the national level through the analysis of export share.

determine a country's weak and strong sectors. It is a method that compares the country's share of the world market in one good relative to its share of all traded commodities. RCA is formulated as (Van Rooyen *et al*., 1999; Hinloopen and Van Marrewijk, 2001; De Benedictis and Tamberi, 2001; Bender and Li, 2002; Alcala, 2009):

$$RCA_{ij} = \frac{E_{ij} / \sum E_j}{E_{iw} / \sum E_W}$$

This equation calculates the RCA[215] for a country (j) exports a commodity (i). If RCA >1. The country (j) enjoys Revealed Comparative Advantage of the studied commodity, so it must be treated with attention to increase its export. In order to identify the revealed comparative advantage of citrus fruit in Syria during 2000-2009, the previous equation is applied as following:

$$RCA_{CS} = \frac{E_{CS} / \sum E_S}{E_{CW} / \sum E_W}$$

Where:

E_{CS} = Value of Syrian exports of citrus

$\sum E_S$ = Total value of Syrian exports

E_{CW} = Value of world exports of citrus

$\sum E_W$ = Total value of world exports

The RCA index is considered as one of the most important indicators that assess the Syrian citrus crops' competitiveness in foreign markets. Table 33 shows the value of Syrian exports of citrus fruits and the total value of Syrian exports during 2000-2009 as follows:

[215] It is very important to indicate that the RCA index takes into account competitiveness factors (such as the exchange rate) which affects the country's exporters and gives results that are measurable by means of comparisons among countries.

Table 33: The values of Syrian exports of citrus fruit and the total values of Syrian exports during 2000-2009 [1]; (Unit: Export value in 1000 US$)

	2000	2002	2004	2006	2008	2009
E_{CS}	21855	14991	6164	16062	9182	13465
$\sum E_S$	4699780	6444190	7113710	10125500	14300000	10900000

[1] May include official, semi-official or estimated data

Source: Own calculation based on (FAOSTAT, 2012) and NAPC database.

With regard to world, Table 34 shows the value of citrus fruits' exports and the total value of exports during 2000-2009 as follows:

Table 34: The values of world exports of citrus fruit and the total values of world exports during 2000-2009 [1]; (Unit: Export value in 1000 US$)

	2000	2002	2004	2006	2008	2009
E_{CW}	4321521	4874559	6676291	7016899	10091548	10169786
$\sum E_W$	6404631190	6441866241	9105338224	11935085771	16043123999	12519746268

[1] May include official, semi-official or estimated data

Source: Own calculation based on (FAOSTAT, 2012) and NAPC database.

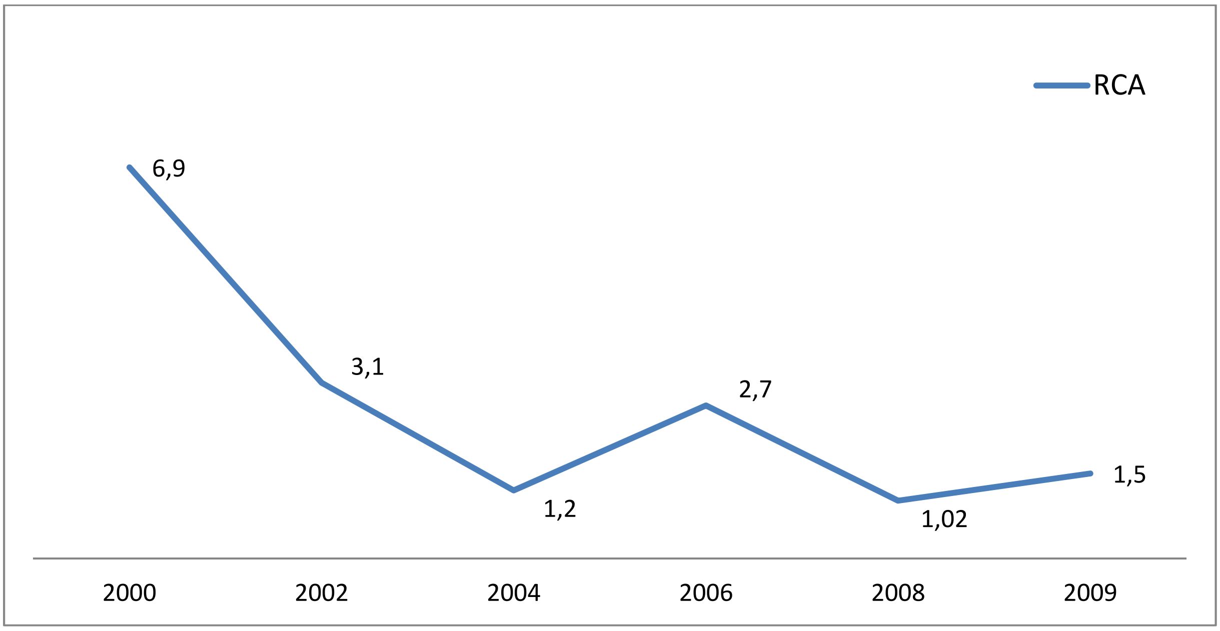
Table 35: Revealed Comparative Advantage of Syrian citrus fruits' exports during 2000-2009; (Unit: Export value in 1000 US$)

	2000	2002	2004	2006	2008	2009
E_{CS}	21855	14991	6164	16062	9182	13465
$\sum E_S$	4699780	6444190	7113710	10125500	14300000	10900000
E_{CW}	4321521	4874559	6676291	7016899	10091548	10169786
$\sum E_W$	6404631190	6441866241	9105338224	11935085771	16043123999	12519746268
RCA_{CS}	6.9	3.1	1.2	2.7	1.02	1.5

Source: Own calculation based on (Table 33 & Table 34)

It is obvious from Table 35 that the exported Syrian citrus fruit has enjoyed (RCA) between 2000 and 2009 as its value has remained more than one for the same period. However, RCA value was on its peak in the year 2000, and then it started to decrease significantly to reach its minimum value in 2008.

Figure 23: RCA of Syrian citrus fruit exports during 2000-2009



Source: Own figure based on (Table 35)

Figure 23 shows that the values of RCA have fluctuated between 2004 and 2009, due to the fluctuation of the exported quantities of Syrian citrus fruit during the same period.

4. Supply chain analysis of the fresh citrus fruits market in Syria

4.1 Purpose and methodology

NAPC conducted in 2003 a study on export promotion for marketing fruits and vegetables of Syria. This study showed that the supply chains of fruit and vegetable are of conventional type[216], which was and is still highly dependent, in some phases of the system, on commissioners. This causes a relatively long and sophisticated distance between farmers and foreign markets, as well as it affects the capacities of exporting Syrian products to other countries, (Alvarez-Coque *et al.*, 2003). This attribute is applicable to the supply chain of fresh citrus fruit[217] in Syria, which is considered one of the important promising commodities that have comparative and revealed comparative advantage in addition to competitive advantage for export to the foreign markets[218]. Therefore, it is very necessary to work for shortening the path between Syrian citrus farmers and foreign markets in order to increase the efficiency of this chain by improving its structure.

The present chapter aims to review the current situation and recent development of the Syrian citrus sector from the perspective of the whole supply chain to allow an analysis of its needs, particularly with regard to research for the improvement of citrus safety and quality. Thus, this chapter provides a description of the different actors and market channels with regard to their task and importance in the supply chain of Syrian citrus fruit market, including the main developments, in order to illustrate its particularities as well as its strengths and weaknesses. In order to assess the main support structures to citrus sector research, the chapter examines the available funding and recent research, the organizations conducting research, citrus sector related networks, and other support organizations including business support organizations. It also considers the policy measures and incentives affecting the sector and the way in which these may influence the safety and quality of citrus supply chains.

There are two resources of the data used in this chapter:

1. Primary data which was collected, between 2005-2009, from the market officials, commission agents/wholesalers, retailers, exporters, farmers, and some experts in

[216] Into this type of chains, the relation between domestic actors and foreign traders and even the retailers is guided by traditional rules, which involve high marketing costs.

[217] Research focuses on fresh citrus sector; therefore the intended meaning of citrus is the fresh citrus fruit unless otherwise is noted.

[218] See Chapter 3.

SMAAR and Ministry of Economy and other official departments in Lattakia, Tartous, and Damascus. The market officials were interviewed and consulted for gathering the information on the overall activities of these markets, marketing infrastructure, and other related information[219]. Interviews were conducted by relying on the Rapid Rural Appraisal (RRA) method, as follows:

- With 10 farmers in Latakia and 5 farmers in Tartous.
- With three exporters from Lattakia, Tartous, and Damascus.
- With 20 retailers.
- With four wholesalers in Lattakia and Tartous.
- With two commission agents in Lattakia and Tartous.

2. Secondary data of the FAO, SMAAR, NAPC, CBS, Eurostat, and Euro-monitor databases.

4.2 Introduction

With respect to the information in chapter 2, Syria was able to increase citrus fruits production from about 350,000 to 1.1 million tons during 1990-2011 (Table 36). The Ministry of Agriculture confirmed that the entire production is free of residual impact of pesticides and chemicals due to the application of IPM and Best Management Practices (BMPs) programs by farmers in cooperation with experts of Citrus Board and extension units which are distributed in the citrus cultivation regions. This production meets the needs of domestic market and juice factories throughout the year; in addition to secure surplus which can be exported to the foreign markets.

In the Mediterranean region Syria had during 2010 an important area designated to the production of citrus fruits (39,518 hectares)[220]. This amount could be compared with Spain (315,000/ 264,800 hectares), Italy (172s589 hectares), Morocco (74,626 hectares), or Egypt (157,090 hectares). At national level the area of land used by citrus cropped is not relevant; it is only 0.69% of the total harvested area (AASA, 2010; FAOSTAT, 2012).

[219] Due to the lack of cooperation and the reluctance of private entrepreneur and most of the interviewed market actors to present their activities; the analysis of the supply chain's structure of Syrian citrus fruit has mainly relied on secondary data and literature.

[220] This area is important because the total area of Syria is much smaller than other compared countries.

With regard to the types of citrus crop, oranges represent the greatest harvest in Syria. The area devoted to the oranges crop is 57% of the total area designated to farm citrus fruit in 2009. Lemons were harvested from 18% of the area, grapefruit, mandarin and other citrus fruits types from the rest of the area (25%), (AASA, 2010).

Table 36: The status of citrus fruit production in Syria (Units: Area in 1,000 Hectare, Trees Number in million, and Production in million tons)

	1990	2000	2005	2011	AAGR %
Total cultivated area with citrus trees	21.3	27.4	31.8	39	**2.92**
Total number of citrus trees	7.8	10.7	10.8	13	**2.46**
Number of citrus trees in fruit bearing	4	8.1	9.4	11	**4.94**
Total production	0.35	0.8	0.7	1.1	**6.38**

Source: Own table based on (AASA, 1990; AASA, 1995; AASA, 2000; AASA, 2005; AASA, 2011)

It can be observed from Table 36 that the progressive growth in total cultivated area with citrus trees[221] has led to a gradual increase in production. In the last twenty years, the production of Syrian citrus fruit has increased by 6.38%. The yields of different citrus varieties have also increased gradually through the same period.

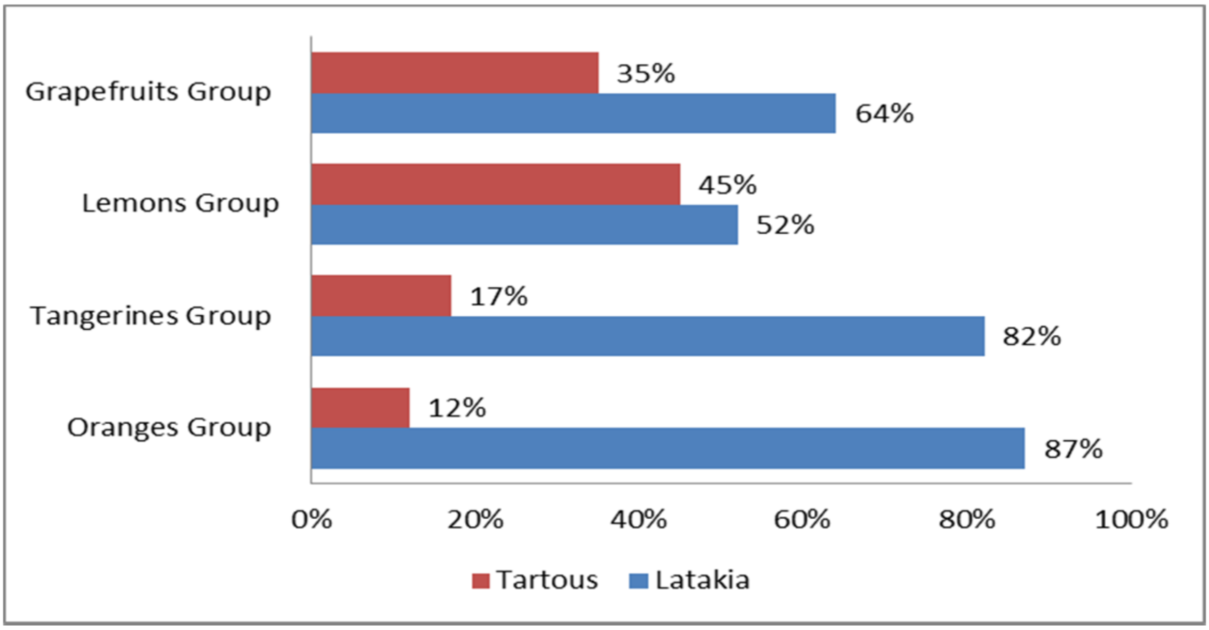
During 2009 in Syria, the average yield for oranges was 30.43 M. T. /hectare, 21.79 M. T. / hectare for Lemons, 21.5 M. T. / hectare for mandarins group and 25.5 M. T. / hectare for grapefruit (Table 9). These yield values can be compared with Spain, for the same year, as follows: 17.9 M. T. / hectare for oranges, 12.97 M. T. / hectare for lemons, 16.61 M. T. / hectare for mandarins group, and 25.8 M. T. / hectare for grapefruit.

The cultivated area with citrus trees is currently 4% of the total cultivated area with fruit trees in Syria. By comparison with the rest fruit trees kinds, citrus trees occupy the sixth rank in terms of cultivated area and the first rank in terms of total production (29% of total fruit trees production in 2011).

It should be noted that the proportions of the main citrus production is concentrated in the governorates of Lattakia and Tartous which constitute 99% of the total citrus production and distribution as presented in Figure 24.

[221] That is because of the limitation of arable areas which can be cultivated with citrus, in terms of availability of suitable environmental conditions.

Figure 24: The distribution of produced citrus fruit proportions in Lattakia and Tartous provinces



Tangerines Group includes also Mandarin and Clementine.

Grapefruit Group includes also pomelo.

Source: Own table based on (AASA, 2011)

Respecting trade of citrus fruit in Syria during 2009, the average export quantity was around 269.8 thousand tons which means 25% of the total Syrian production of citrus and 0.2% of the total world production of citrus. In reference to the import quantity, the average of import quantity was around 38.6 thousand tons which means around 3.5% of the total Syrian citrus production; this percentage is not comparable with the exports.

4.3 Post-production operations

In Syria, significant quantities of citrus are harvested in each month from September up to June, while the bulk of the crop is being harvested from December to March. The main harvest of mandarin precedes the main harvest of orange. However, there is considerable overlap. For example, Navel oranges are harvested up to four months before late hybrid mandarins.

Citrus fruits' varieties, which are cultivated in Syria, can be arranged due to their maturity appointments as shown in Table 37:

Table 37: Classification of the cultivated citrus fruits varieties in Syria according to their maturity appointments

	Early Maturing Varieties (September–December)	Medium Maturing Varieties (January–March)	Late Maturing Varieties (March–June)
Orange Group	Cadanera, Navel, Acidless (Succari), and Hamlin	Jaffa, Khettmali, Cadanera, and Maltaise	Jaffa, Maltaise, Valencia, and Blood oranges (Mauardi)
Lemon Group	Lime, Villafranca, Lisbon, Femminello, Improved Meyer, and Eureka	Lime, Villafranca, Lisbon, Femminello, Improved Meyer, Eureka, Monachello, and Sassli	Lime, Villafranca, Lisbon, Femminello, Improved Meyer, Eureka, and Sassli
Mandarin Group	Clementine, Satsuma, Fremont, Fairchild, Page Mandarin, Tangelo Nova, Orlando Tangelo, and Carvalhais Mandarin	Clementine, Ponkan, Wilking, Murcott, Dancy Tangerine, Mandalina, Temple, Minneola, and Yousef Effiendi (Baladi)	Ortanique, Mandarin, Forton, Temple, Murcott, Tangerine hybrids, Pixie, Minneola, and Malvasio
Grapefruit Group	Shambar G., Star Ruby G., Red G.	Shambar G., Red Blush G., Thompson G.	Marsh G.

Source: Own table based on (CBD, 2005)

According to information in the above table, the processes of harvesting and marketing of citrus crop in Syria are conducted in accordance with the following time sequence:

1. Marketing season of citrus starts in early October with harvesting of Satsuma and early hybrid mandarins.
2. The harvest of mandarin runs through until March.
3. Clementine is being harvested from November to January.
4. The orange harvest starts with the Navel variety, which is picked from November to January.
5. The main Jaffa variety is harvested in February and March.

6. The Valencia harvest runs from April to June.
7. Grapefruit are harvested from November to February.
8. Lemons are picked throughout the year.

Citrus farmers often delay the harvest of crop[222], partly, in order to obtain higher prices later at the end of season. On the other hand, domestic marketing season of oranges can be extended until August through waxing and storage. The advantage of getting better prices by the process of waxing and storage are becoming increasingly widespread, especially among the larger farmers. Therefore, the installation of waxing lines over the past years has been accelerated dramatically. Nonetheless, most farmers still deliver their production to the wholesale market on the day of harvest.

In general, citrus growers harvest, pack and market their production themselves by using either family labor only or a combination of family and hired labor. However, a few of the large farmers are using hired labor only.

A minority of farmers sell their crop on the tree to the owners of packaging workshops or manufacturers. In this case, the buyer usually provides labor for harvesting and packaging which helps to ensure the availability of crop at the right time for the buyer and also allows him to monitor the reaping method and its quality. This leads to reduce the proportion of the fruits that must be rejected during sorting because they are unsuitable for storing. In other words, the buyer takes care of all post-production operations such as picking, classification, packaging, boxes, transportation, and costs.

Up to 2000, there were no national grades and standards for citrus in Syria. Growers used to classify and sort their harvested fruits into grades from two to four depending on their prior marketing experience, in order to maximize the net value of their sales of the cost of grading. Principally, sorting is based on the fruit size, where the medium-sized fruits are normally being graded highest.

In 27.09.2000, the Syrian Ministry of Industry issued the resolution No. 237 that applied the standard No.64 about citrus, the first adjustment, which included the required citrus quality

[222] Citrus can be stored on the tree for several months. However, storage on the tree is risky since it may result in losses and there is normally some deterioration in quality. For example, it is also risky to the most of mandarin varieties that may be exposed to frost.

standards for marketing and consumption. However, processing standards were not included. These standards are listed as follows:

1. Fruit should be fresh, ripe, clean, and free of any diseases or any strange smell or taste.
2. The proportion of pesticide residues should remain within the recommended limits which were settled internationally or nationally.
3. Citrus fruit should contain, at least, lowest limits of juice and color.
4. Fruits should be stowed in suitable packages.
5. Accordingly, citrus fruits were graded into three categories: excellent grade, first grade, and second grade.

Citrus fruits are usually cleaned on the farm with water or with water and detergent. Farmers of smaller and less sophisticated farms often only wash their fruits if they are muddy.

Some large farms have their own automated packaging lines that include washing, drying, waxing and grading equipment. A small number of citrus farms also have cold stores. Farmers with such facilities wax and store their own crop and also store the production of other farmers for a fee.

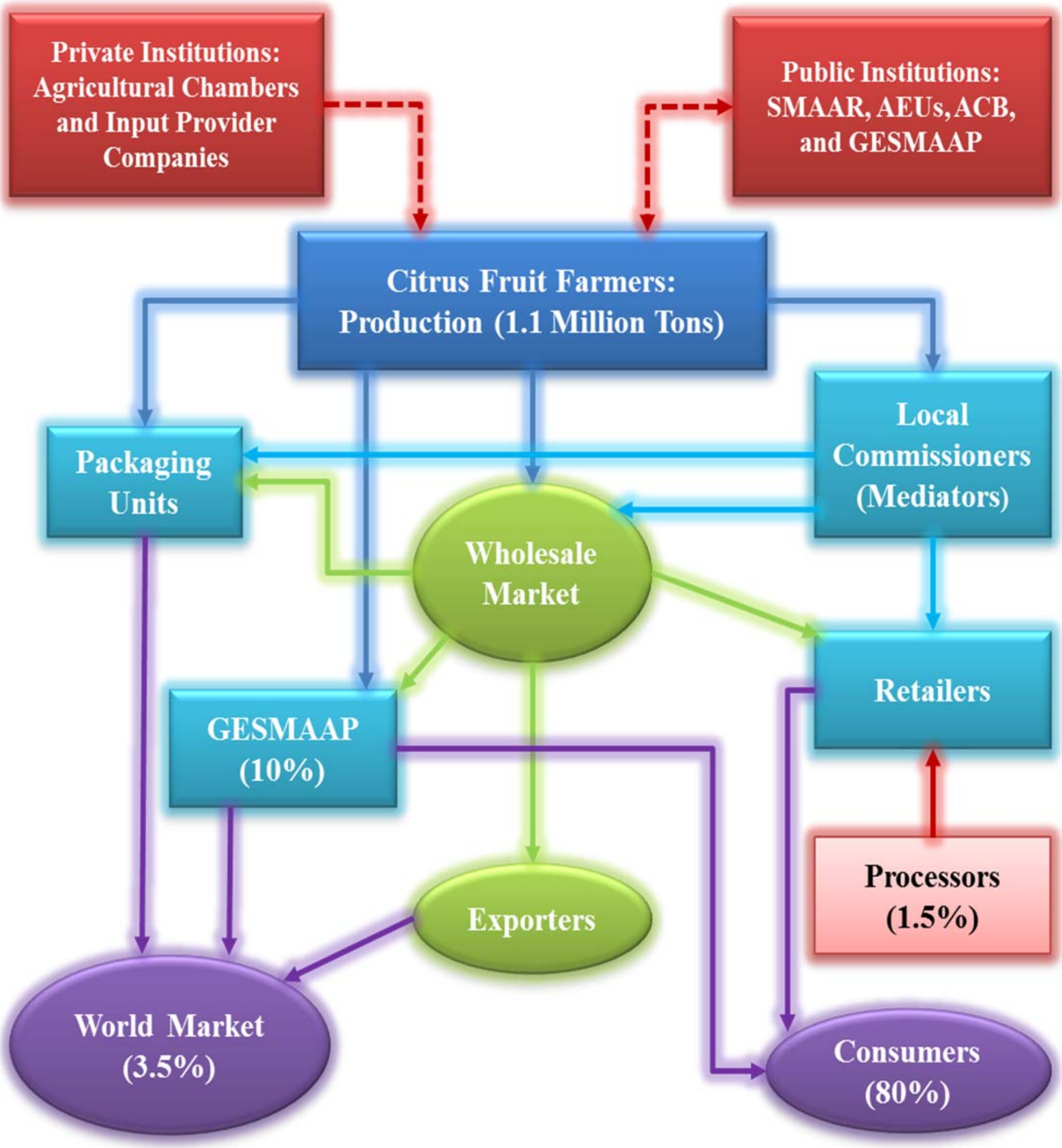
In order to collect the harvested citrus fruits on-farm, sturdy plastic crates holding 22 kg are used. After sorting, citrus is packed into smaller, less substantial polystyrene or plastic crates holding 13-14 kg. Some growers use plastic for first grade citrus and polystyrene for lower grades.

4.4 The organization of citrus fruit marketing

The most important problem which faces the marketing organization of citrus fruit in Syria lies in the fragmented nature of the value chain, which makes it difficult to transmit the market signals from the demand to the supply (Alvarez-Coque et al., 2003).

Figure 25 presents a comprehensive overview of the ramifications of citrus value chain, which allows understanding the intersections and the possible relationships between the actors along the chain. It shows also that the chain is not very complex, as it includes a lot of actors and processes; however, its complexity results from several actors playing similar roles such as growers, exporters, and traders.

Figure 25: Value chain of Syrian citrus fruit[223]



Source: Own figure based on (Hosni and Lancon, 2011; Karkout and Lancon, 2011; Al-Hamwi and Lancon, 2011)[224]

It is noticeable from that the domestic market of citrus fruit in Syria includes the following actors (Figure 25):

1. Private citrus farms: All farms which are producing citrus fruits in Syria are private. These farms produced in 2009 about 1.1 million M.T. of citrus; the vast majority of these quantities was marketed to the domestic markets. However, the Citrus Board

[223] For more details about the marketing of citrus fruit in Syria, see appendix 23.

[224] All these studies are based on a combination of value chain approach with the facets of Porter's diamond.

estimates that about 10% of citrus production is not harvested or is unusable because of on-farm damage and deterioration. Thus the marketed quantities from the farm gate are usually 10% less than the domestically produced quantities.

2. Traders: Generally, traders and exporters of citrus are sometimes the same persons, implying that their role in citrus marketing is similar. However, only very small citrus producers directly sell their production to the domestic traders.

3. Local commissioners (Mediators): They are playing a very important role in the wholesale market, especially during the ripeness season, as they constitute a link between producers and retailers by bargaining with buyers for the benefit of producers. In general, each group of producers has their own mediator which they deal with in the market. For doing this service of arranging sales, the mediator is charged 5% as a commission from the producer.

4. Retailers: They are buying citrus fruit from the wholesale market and selling it to consumers in their shops or by peddlers.

5. Public institutions: There are a lot of bodies that provide services to the stakeholders along the citrus value chain, for instance:

    - SMAAR intervenes through agricultural production, marketing, economics, and extension directorates that are involved somehow in the activities of this chain and provide different services.
    - Ministry of Economy and Trade works throughout the General Establishment of Storing and Marketing Agricultural and Animal Products (GESMAAP) as trader, exporter, and controller of supply balance in critical time. The GESMAAP was established in 2000 by resolution No. 534 as a result of consolidation of three companies (General Establishment of Meat, General Establishment of Fruits and Vegetable[225], and General Establishment of Storing and Freezing). In 2001, GESMAAP started to work by dealing with

[225] This company was established by Syrian government in 1977. Its main function was to act as a buyer of fruit and vegetable products government-administered prices to distribute them into remote areas. The GEFV had had a citrus packing line in Lattakia but it was little used. Due to the complex bureaucratic procedures involved and, in particular, because there were substantial delays of uncertain duration before the company makes payment of commodities; farmers and traders were reluctant to use its facilities. As a result, there was a reduction in its role in marketing of fruit and vegetables products, including citrus fruit.

different kinds of products such as fruits, vegetables, chicken, and sheep meat. For citrus, the establishment buys the products directly from the producers on a contractual basis. GESMAAP is purchasing around 10% of total citrus fruit production. About 20% to 25 % of these quantities are exported to the Arab regional markets. The rest of the quantity goes to the local market, is retailed through public or private shops, or stored[226] to be distributed during the months of scarcity. The establishment also has a modern line for sorting and packaging fruit and vegetable.

- Agriculture Cooperative Bank (ACB) is one of the service providers along the chain that provides two types of loans, cash and in kind.

6. Processors: Citrus manufacturing is a marginal outlet for citrus producers and processors. Only about 1.5% of total citrus production goes into processing. Citrus juice is mostly produced by factories which are not specialized in processing of citrus juice only. Mountain Fruit Juice company, for example, which was established in 1992 according to the Investment Law No. 10[227], works in producing different products of juices like apple, grape, tomato, apricot, orange, grapefruit, mango, and pineapple. Also it produces several sorts of marmalade like orange, apple sauce, apricot, cherry, and strawberry in addition to tomato paste. Although the Investment Law No. 10 imposed upon the owners of fruit processing companies to buy 100,000 tons of produced citrus in Syria annually, they did not abide by these quantities. Furthermore, they use the concentrates of citrus juice which is imported from abroad in manufacturing citrus juices[228]. Thus, they have benefited from the privileges and exemptions which are given by Investment Law No. 10 without fulfilling their commitments.

7. Consumers: Citrus is a popular fruit in Syria. Most consumers prefer to consume fresh citrus fruits while small quantities of citrus are consumed as juice or used for candies and marmalade.

[226] For example, the GESMAAP has two units for storing and cooling. Their storage capacity is up to 5,000 tons of different products such as citrus, apple, potato, in addition to meat, banana, and all other food commodities.

[227] This law was issued on 04.05.1991 and amended by Legislative Decree No. 7, issued on 13.05. 2000.

[228] The reason of using imported concentrates lies on the cost, as the cost of importing the concentrates of citrus juices is less than the cost of their manufacturing.

4.4.1 Wholesale markets

In Syria, there are 14 major fruit and vegetable wholesale markets (named as Souq Al-Hal). They are located in the major cities and towns. The vast majority of citrus growers sell their production at these wholesale markets. Usually, they transport their harvested production in small hired trucks of 3-5 tons. However, some better-off growers have their own trucks. In general, the farm householder or one of the family members travels to the market with the truck. In some cases, when small farmers have insufficient quantities of citrus fruit to fill a truck, they transport their produce jointly with others. On arrival at the wholesale market, each farmer sells his produce separately. Occasionally, a wholesale market trader may arrange to buy citrus at the farm gate and then transport it to his market for sale.

Trade operations within wholesale market are organized in informal and opportunistic ways. For instance, about 250 traders are working at the Damascus wholesale market, of them about 60 traders are dealing with citrus. The majority of traders act as commission mediators. They usually organize sales between farmers and buyers and charge a commission of 5 % for this service. In a few cases, they act as wholesalers by buying from farmers and selling on their own account. Semi-wholesalers and retailers are the main buyers at the wholesale markets. Unlike that, exporters and processors prefer to contract directly with larger farmers; however, they also purchase citrus fruit from the wholesale markets.

The wholesale markets are usually open 24 hours a day, especially in the main cities like Damascus and Aleppo. After the produce has reached the market, negotiation between seller and purchaser begins without a prior agreement to determine prices. Buyers may purchase a full lorry load or a part of a load only. Normally, produce is sold on the day of delivery with no overnight storage. However, produce is held overnight in the absence of a buyer or a lack of an acceptable price; in this case, the farmer bears the risk of physical losses and the decline of prices. Farmers, in general, deal with the same trader at a particular market. This is sometimes because the trader has provided loans to the farmer, but also reflects trust in a particular trader, developed over a number of years. Sometimes, against this prepayment, farmers may agree to sell to or through a particular trader up to 6 months before harvest.

In respect of the fruits grading process at the market, traders depend on their experiences to judge quality. Citrus is normally packed and sold in the plastic or polystyrene crate. However, traders often rebuy crates from retailers and sell them back to farmers.

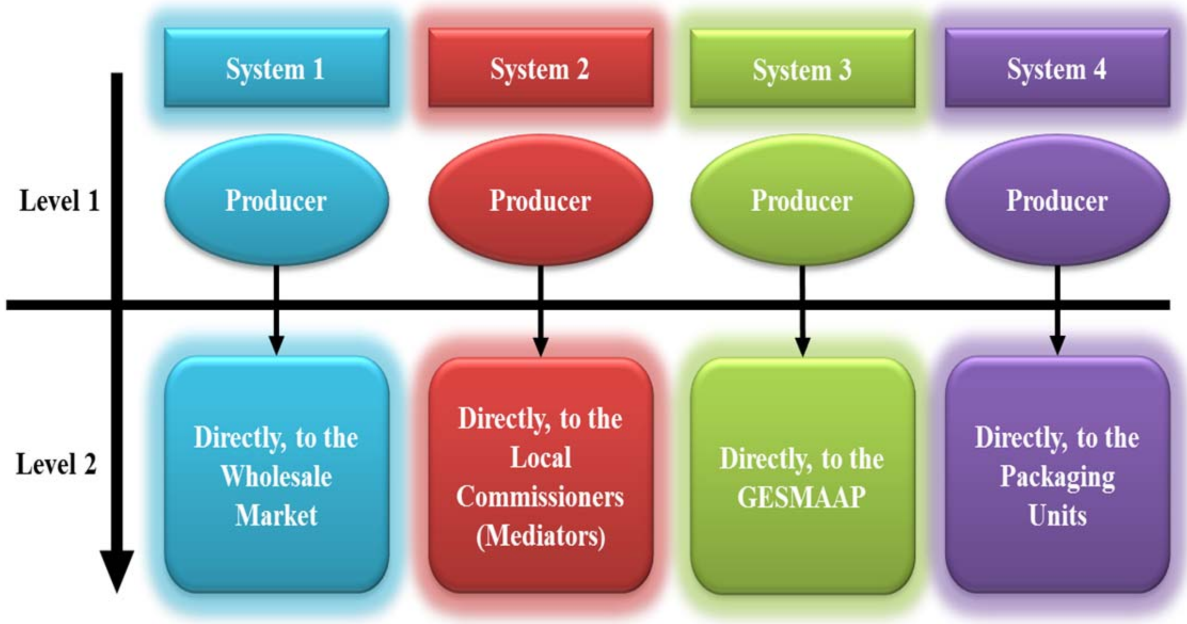
Usually, farmers get payment for their merchandise in cash at the time of sale. Exceptionally, when a farmer asks a trader to arrange waxing and/or cold storage, in this case, he should not be able to obtain an acceptable price on the day of delivery.

There are a few dozen of packers who work outside the wholesale markets and export citrus fruit directly to the foreign markets. However, most exports are traded by non-specialized operators who, very often, make their purchases at the wholesale market. In a way, for them, the export market acts as an extension of the domestic marketing and very often the traders who sell inside Syria are the same who export to the outside.

According to the previous description of the organization of citrus fruit marketing in Syria, it is clear that the main actor of the citrus supply chain is the trader, who plays different roles along it. And the main destination of citrus fruit is the wholesale market that deals with most quantities of citrus by gathering and distributing them to the different actors and activities.

Four major sub-systems for the marketing of citrus crops can be derived from the supply chain flow charts, which are taking into account the various destination of the production and the seasonality of marketing. Figure 26 shows the way of marketing in the four systems.

Figure 26: The marketing systems of citrus fruit in Syria



Source: Own figure

The first system concerns the direct selling of citrus fruit by the farmer to the wholesale market during the main producing season. This system represents the majority of citrus marketing flows, 70% in average.

In the second system citrus production is sold directly to the local commissioners by unwritten contract before or in the ripeness season at the farm gate. Usually, they act as domestic traders and exporters in some other cases. They also may sell their purchasing quantities of citrus fruit in the wholesale market. This system constitutes a small proportion of citrus marketing flows.

For the third system, citrus growers sell their produce to the GESMAAP at the farm gate by written contract. This system represents about 10% of the citrus marketing flows.

The fourth system concerns the direct selling of citrus fruit to the packaging units. Their owners act as exporters. This system constitutes a very small proportion of citrus marketing flows.

Based on the previous estimations, it is worth to mention that around 80% marketed citrus fruit goes to the wholesale market which is the major marketing line for citrus crops in Syria (systems 1+2).

4.4.2 Market information and the assessment of price trends

There is no formal market information system for fruits and vegetables. Farmers, for example, farmers typically call commission mediators at several wholesale markets to get an idea about the potential prices before deciding where to deliver their crops. However, this has disadvantage if the agents do not give farmers the right picture of price conditions at their particular market in order to encourage them to market the produce to them.

The information system within the Syrian fruit and vegetable markets is characterized by the following attributes (Westlake 2000; Westlake 2001; Alvarez-Coque et al., 2003):

1. Markets lack price transparency, since no price information is publicly disseminated to the traders across the marketing chain.
2. There is also lack of information about production costs and the available data is only approximate.
3. The information about the number of exporters is not clear, although an estimative figure could be a few hundred.

4. The marketing system does not allow for an efficient export chain. That is because exporters are not in full control of the quality of the citrus products and direct contacts with farmers are not the rule. Also, even when exporters buy directly from farmers, products may not be graded effectively at the farm, and this frequently involves the need for double handling or rejections of non-exportable qualities.
5. Within wholesale markets there is no use for the weighbridges. Also there are no records about the marketed quantities of fruit and vegetable which are collected by the market authorities[229].
6. Generally, there is a clear need for a formal market information system, under which data on prices at each major wholesale market are collected, analyzed and rapidly disseminated.
7. The estimated data of wholesale market prices shows considerable differences between markets with regard to the mean monthly prices. Such variations are well in excess of those that can be explained by transport cost differences. This suggests that farmers do not have access to the price information which is required to ensure that they always deliver their crops to the market which will give them the highest net return.

At Syrian wholesale markets, the prices of fruit and vegetable are determined by market forces (supply and demand). However, market prices, during the same season, vary according to the time, cities, and markets in which the products are being marketed. Prices are usually settled at the market, except in some cases of export, where the exporter holds a deal with the farmers and detects a preliminary sorting and grading at the farm.

Table 38 gives an idea about the wholesale prices for the main types of citrus fruit during 2008-2010. It is obvious that the wholesale prices of lemon decreased by 11.4% between 2008 and 2010 as a result of a significant increase of lemon production for the same period (Table 7). On the other hand, the wholesale prices of oranges and grapefruit maintained a low rate of growth. The main reason for that was related to the fluctuation of transportation costs due to the increase of fuel prices in Syria. Concerning clementine prices, it had no changes which can be interpreted as a result of supply and demand balance in the market (Figure 27).

[229] They are called the Wholesale Market Commission which acts as a representative of traders and exporters. Contrary to that, the day-to-day running of the markets is the responsibility of each Governor’s office.

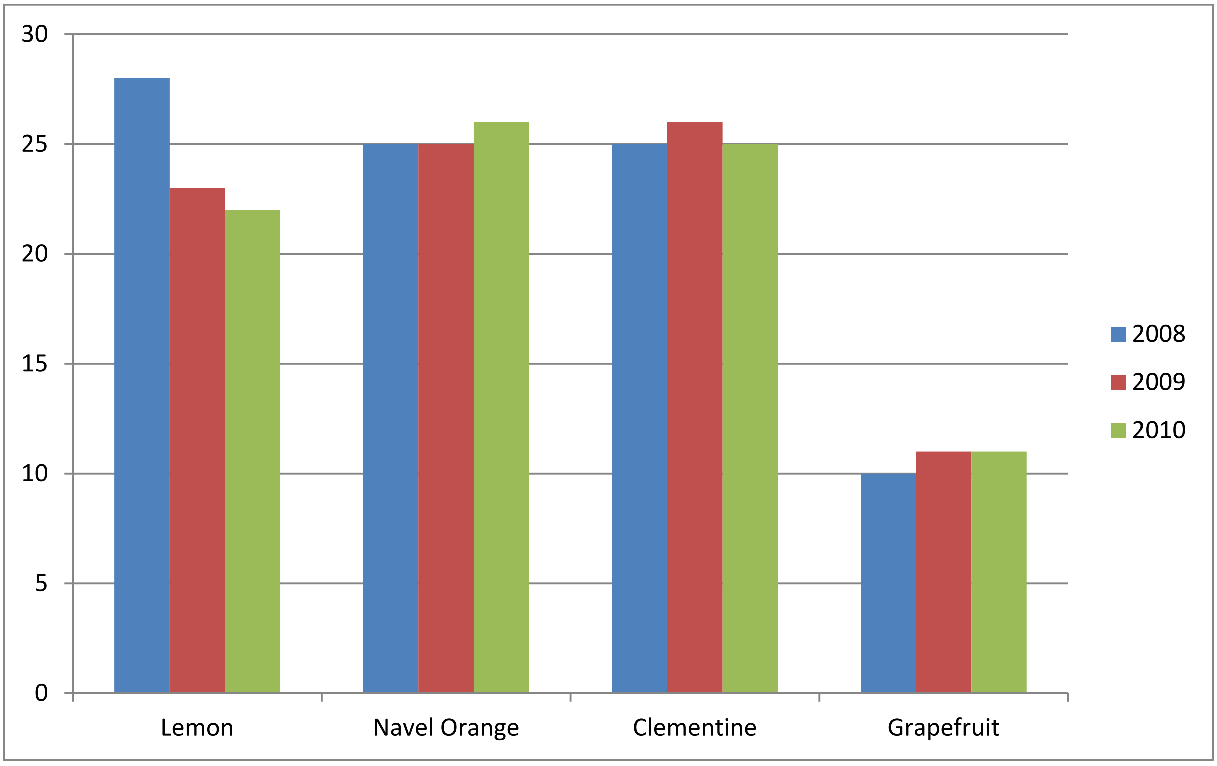
Table 38: The average of wholesale prices for the main citrus fruit types (2008-2010); Units: SP/kg & AAGR (in %)

	2008	2009	2010	AAGR %
Lemon	28	23	22	**-11.4**
Navel Orange	25	25	26	**2**
Clementine	25	26	25	**0**
Grapefruit	10	11	11	**4.9**

Source: Own table based on (AASA, 2008; AASA, 2009; AASA, 2011)

Wholesale prices of lemon have been more unstable during 2008-2010 than the prices of oranges and mandarins which had no noticeable downward trend (Figure 27). It is known that lemons are an important integrated component of many Syrian cuisines; unlike that, oranges and mandarins tend to be consumed fresh and can be substituted with other fruits. Thus, the demand for lemons is almost certainly less price elastic than that for oranges and mandarins. This is likely to be the main explanation for the instability in annual wholesale prices for lemons.

Figure 27: Development of wholesale prices average for the main citrus fruit types (2008-2010); Prices in SP



Source: Own figure based on (Table 38)

Table 39 illustrates the average weighted wholesale price, index numbers[230], and the discounted prices of citrus fruit at the wholesale markets between 2008 and 2010[231]. As shown below, an increase occurred to the index number of wholesale prices of fruit and vegetable (Laspeyres) and to the general price index. However, it accompanied with a decrease in the average weighted wholesale price of citrus which led to a decline in the discounted prices (1) and (2) during 2008-2010.

Table 39: Evolution of the wholesale prices and the index numbers of citrus (2008-2010); (2005=100); Units: SP/kg & AAGR (in %)

	2008	2009	2010	AAGR%
Average weighted wholesale price of citrus	22	21.25	21	**-2.3**
Index number of wholesale prices of fruit and vegetable (Laspeyres)	125.52	168.1	190.3	**23.1**
General price index	115.39	145.02	160.13	**17.8**
Discounted price (1)[1]	19.07	14.65	13.11	**-17.1**
Discounted price (2)[2]	17.53	12.64	11.04	**-20.7**

[1] Discounted price (1) was calculated by dividing the average weighted price on (the general index number; Laspeyres)/100.
[2] Discounted price (2) was calculated by dividing the average weighted price on (the index number of wholesale price for fruit and vegetables; Laspeyres)/100).

Source: Own table elaborated from (CBS, Several Issues; AASA, 2008; AASA, 2009; AASA, 2011)

Table 40 represents the evolution of the average weighted retail prices, the index numbers, and the discounted prices of citrus fruit during 2006-2010. It is clear that the decline of average weighted retail price of citrus has led to a remarkable decrease in the discounted prices (1) and (2). Contrary to that, there was an increase in the index number of fruit retail prices and the general price index.

[230] See appendix 24.

[231] Due to the lack of data on wholesale prices for citrus fruit before 2008 and the index number of wholesale prices of fruit and vegetable (Paasche) during the studied period. Therefore, the calculation of the table has been depended on the general price index in addition to the index number of wholesale prices of fruit and vegetable (Laspeyres).

Table 40: Evolution of the retail prices and the index numbers of citrus (2006-2010); (2005=100); Units: SP/kg & AAGR (in %)

	2006	2007	2008	2009	2010	AAGR%
Average weighted retail price of citrus	33	32	41	34.6	26.6	**-5.25**
Index number of retail prices of fruit	121.46	133.6	156	152.6	156.2	**6.5**
General price index	110.03	115	132.4	136.1	142.1	**6.6**
Discounted price (1)[1]	30	27.83	31	25.4	18.7	**-11.12**
Discounted price (2)[2]	27.2	24	16.3	22.7	17.03	**-11.02**

[1] Discounted price (1) was calculated by dividing the annual average retail price of citrus on (the general price index/100)
[2] Discounted price (2) was calculated by dividing the annual average retail price of citrus on (the index number of retail price of fruit/100).

Source: Own table elaborated from (CBS, Several Issues)

A summary statistic of the retail prices time series of lemon and Navel orange by governorates, between 2005 and 2010, is presented in Table 41. As shown below, the retail price of lemon in all governorates was subject to substantial price variations ranging between CV = 38% in Damascus, Rural Damascus, and Aleppo and CV = 45% in Al-Hassakah. The variations of orange retail price were less than in the case of lemon. Whereas Idleb was recorded as the governorate with the highest CV (23%) in retail prices followed by Lattakia (21%); the lowest variation was in Rural Damascus and Quneitra with 8% and 7% respectively.

Analysis of market price data shows that retail market prices for the main types of citrus are lower in the markets of the main producing governorates of Tartous and Lattakia than they are in Damascus, for example. Generally, there are substantial differences between major towns and cities in monthly wholesale and retail prices, but no obvious patterns. This suggests that the national market is not well integrated.

Table 41: Summary statistics of the retail price time series of lemon and orange (Navel) by governorates (2005-2010); Unit: SP/kg

	Lemon				Orange (Navel)			
	Mean	Min	Max	CV%	Mean	Min	Max	CV%
Damascus	34	17	52	38	38	26	42	16
Rural Damascus	34	19	51	38	36	32	39	8
Aleppo	31	16	50	38	31	27	38	16
Homs	30	16	47	41	32	21	39	19
Hama	28	15	44	39	31	19	35	19
Tartous	26	15	42	39	29	23	32	11
Lattakia	27	15	45	41	28	19	36	21
Idleb	29	13	45	42	30	19	38	23
AL-Raqqa	33	16	53	43	33	22	41	20
Dier-Ezzor	34	17	56	42	35	24	44	20
Al-Hassakah	31	14	52	45	33	23	39	17
AL-Sweida	32	14	51	42	35	24	41	17
Dar'a	33	16	54	41	36	29	40	11
Quneitra	31	14	48	45	34	30	35	7

Source: Own calculation, based on (CBS, Several Issues)

It is very necessary to conduct an analysis of the monthly variations on the retail and wholesale prices of citrus fruit in order to give a more precise description of the price trends during the citrus season and off-season. However, due to the lack of the required monthly data, the study has been restricted to the previous assessment.

4.4.3 Citrus demand in Syria

4.4.3.1 Evolution of citrus consumption

Usually, 95% of domestically marketed citrus fruit quantities are consumed freshly, while only a small proportion is exported and manufactured (Figure 25). Meanwhile, the domestic demand on the different types of fruits is rather static (Table 42)[232]. This might be related with various factors, which are certainly a type of diet transition. However, at an initial stage, which was associated with income increase and the higher availability of citrus and other fruits through the improvement of transports and marketing in addition to dissemination of cold-storage technique, the consumption of fruits tends to penetrate into most market segments of the population. This has occurred as a result of the diet diversification increase which imposed the consumers to diversify their consumption (new fruits varieties are

[232] Consumption is influenced by domestic demand and production; as any change occurring in domestic demand leads to the same change in consumption and vice versa. see section (4.4.3.2)

available on the market). Thus the per-capita consumption of grapes and apples, for instance, declines due to the substitution of other type of fruits and the significant increase of citrus production.

Table 42: Evolution of the apparent consumption per capita[233] for the main fruits during 2000-2009 in Syria; Unit: kg/per capita

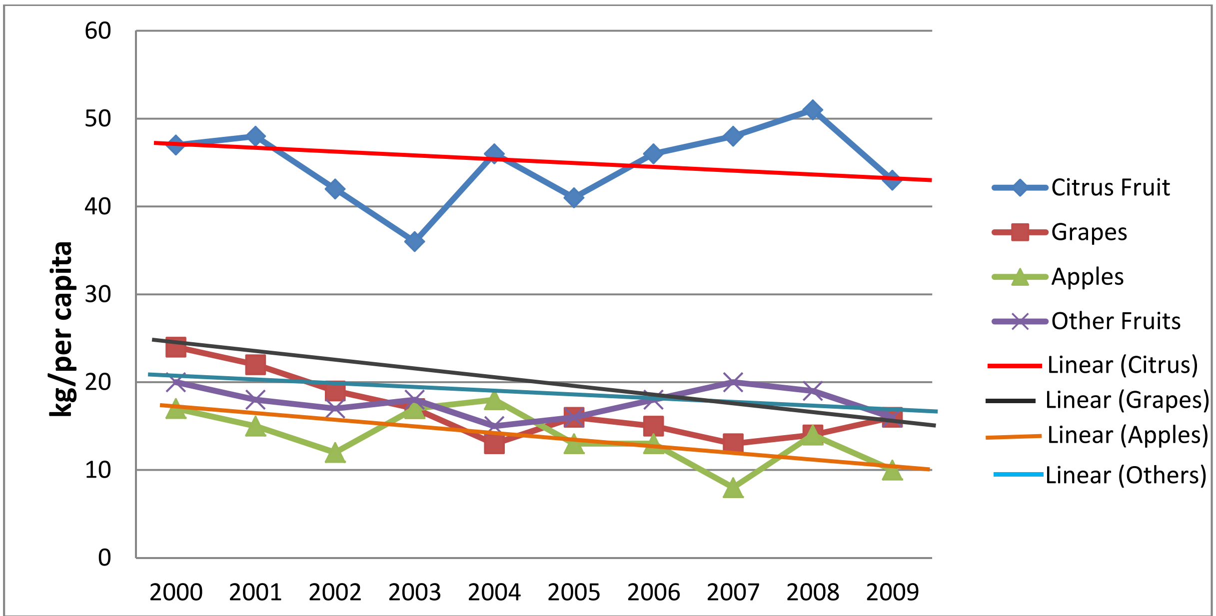
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	AAGR %
Citrus	47	48	42	36	46	41	46	48	51	43	**-1**
Grapes	24	22	19	17	13	16	15	13	14	16	**-4**
Apples	17	15	12	17	18	13	13	8	14	10	**-6**
Others[1]	20	18	17	18	15	16	18	20	19	16	**-2**

[1] These other fruits includes: Fig, Apricot, Pear, Plum, Cherries, Peach, Quince, and Pomegranate.

Source: Own table computed from (AASA, 2010)

As shown in Table 42, the apparent consumption per capita of citrus fruit maintained higher levels than other fruits during 2000-2009. The trend lines in Figure 28, illustrate a slight decline in per capita consumption of grapes, apples and other fruits with less fluctuations while citrus fruit per capita consumption shows a decrease by -1% only but a more unstable trend. The apparent per capita consumption of grapes and apples has declined by -4% and -6% respectively during the study period.

Figure 28: Trends of the domestic per capita consumption for the main fruits between 2000 and 2009; Unit: kg/per capita

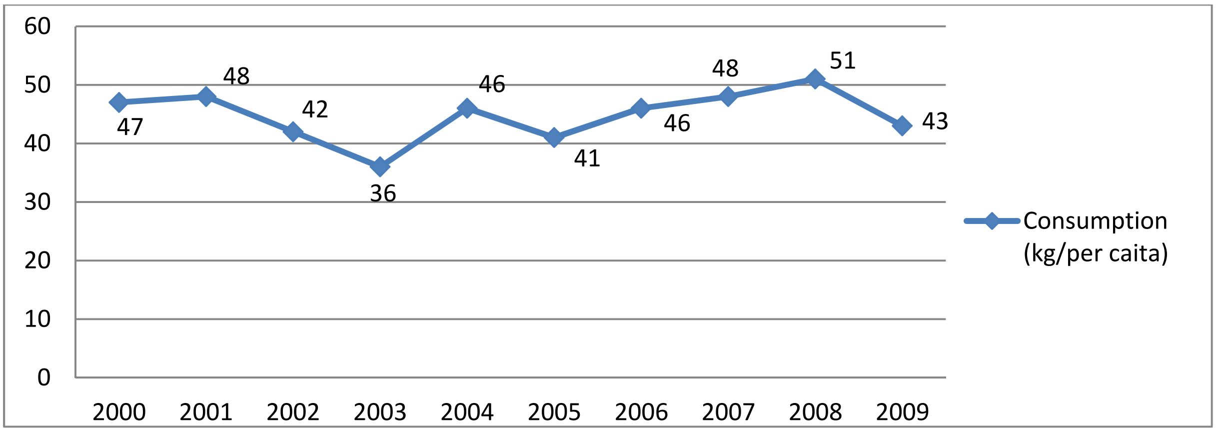


Source: Own figure based on (Table 42)

[233] The apparent consumption per capita is the proportion of domestic demand (available) to the population.

Figure 29 illustrates that the apparent consumption of citrus fruit per capita tended to decline down from 47 kg to 36 kg between 2000 and 2003. This declining trend of consumption could be mostly related to the instability of citrus production as a result of climatic conditions parallel with an increasing number of populations. And may be also related to the development of exports at the consumers' expenses. Also part of this instability could be related to income level as it is perceived that the citrus prices increased during the period pointed out to. However, this consumption per capita return to rise again up from 36 kg to 51 kg between 2003 and 2008, as a result to remarkable increase of citrus production for the same period.

Figure 29: Apparent consumption of citrus fruit in Syria during 2000-2009



Source: Own figure based on (Table 42)

4.4.3.2 The commodity balance of Syrian citrus fruit: increasing surplus

Based on the above, the citrus supply chain includes the following actors: private farms, wholesalers (mediators, importers and exporters), processors, retailers, and final consumers. The commodity balance consists of production, export, import, domestic demand (available), and the aggregate supply which comprises the local production and import. Domestic demand is estimated by deducting exports from aggregate supply. The aggregate demand comprises domestic demand and export.

As shown in Table 43, the ratio of self-sufficiency exceeded 100% in all years for citrus during 2000-2009 and reached its peak 127% in 2009. So, the domestic production was higher than the internal demand, in spite of the high populating rate in Syria. This situation refers to the existence of a trade surplus of citrus which can compete in internal and external markets.

Table 43: Citrus fruit commodity balance during 2000-2009; Unit: Per 1000 M.T.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	AAGR %
Production	800	833	746	652,5	844	777,8	907	967	1046	1093	3.5
Import	0	7	9	12	18,6	19,6	21	25	46	39	-
Export	39	45	29	28,9	27,8	53,5	75	81	85	270	24
Aggregate supply	800	840	755	664,5	862,6	797,4	928	992	1092	1131	4
Aggregate demand	800	840	755	664,5	862,6	797,4	928	992	1092	1131	4
Domestic demand	761	795	726	635,6	834,8	743,9	853	911	1007	861,4	1.4
(%) Self-Sufficiency[1]	105	105	103	103	101	105	106	106	104	127	2.1

[1] Self-Sufficiency (%) is the percentage of total production to the domestic demand (available).

Source: Own calculation based on (AASA, 2010)

The annual growth rate illustrates that the exported quantities of citrus has been increased significantly by 24% during the studied period. This is due to the regional trade agreements between Syria and Arab countries[234] in addition to Turkey, and the exports promotion policy which is applied by the Syrian government to encourage exporting of products which have comparative and competitive advantages, such as citrus fruit which is the subject of this study. The increase of citrus production also helps to increase exports. Citrus production has been increased by 3.5%. The domestic demand (available) and self-sufficiency has been slightly increased by 1.4% and 2.1% respectively. Thus, the production of citrus is sufficient to meet the domestic demand with surplus to be exported (Table 43).

Table 44: Summary statistics of the citrus commodity balance during 2000–2009; Unit: Per 1000 M.T.

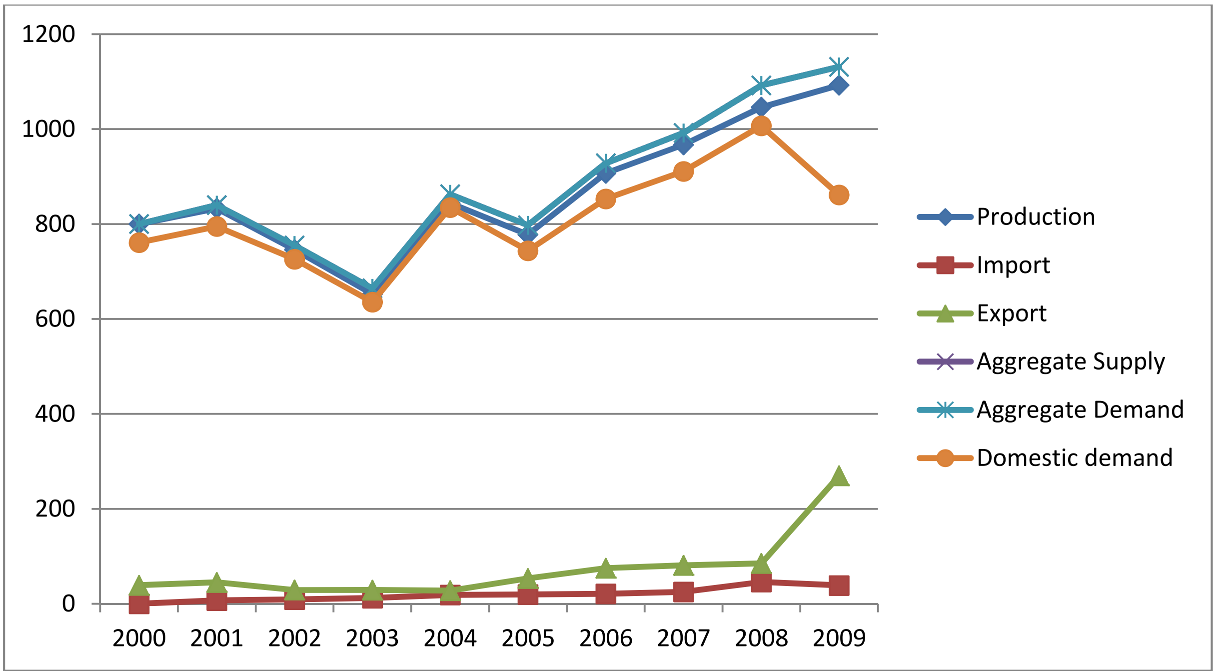
	Mean	Minimum	Maximum	CV (in %)
Production	866.59	652.5	1092.6	16
Import	19.68	0	46	72
Export	73.4	27.8	269.8	99
Aggregate supply	886.27	664.5	1131.2	17
Aggregate demand	886.27	664.5	1131.2	17
Domestic demand	812.87	635.6	1007	13

Source: Own calculation based on (Table 42)

[234] GAFTA

Table 44 illustrates the statistical description of the citrus commodity balance from 2000 until 2009, and Figure 30 shows the evolution of the citrus commodity balance during the same period.

Figure 30: Evolution of the citrus commodity balance during 2000-2009; Unit: Per 1000 M.T.



Source: Own figure based on (Table 42)

The above figure clarifies that the trend of export and import stay almost stable in spite of the variation of production during the studied period. The aggregate supply of citrus harmonizes with production variation. It also shows that Syrian citrus consumption is mainly dependent on domestic production to meet the needs of consumers. Import volumes remain low and are not exceeding 4% of production.

4.4.4 Syrian citrus fruit trade

Arab countries are considered as the first trade partner with Syria in agricultural products trade. A lot of improvements concerning Arab trade occurred at the beginning of 2005 such as releasing the trade between the members of the Great Arab Free Trade Agreement (GAFTA), facilitating the commercial boundaries by eliminating customs duties and the list of the agricultural commodities that were subject to import ban and canceling the agricultural calendar. As a result of these procedures, the total trade size increased from 60.736 billion SP in 2000 to 373.939 billion SP in 2009 and the AAGR during 2000-2009 was 22.4%. During the same period, the total agricultural trade size increased from 23.548 billion SP in 2000 to

151.963 billion SP in 2009 and the AAGR during 2000-2009 was 23%. Thus, the proportion of total agricultural trade size to the total trade size increased from 38.8% to 40.6% during 2000-2009 and the AAGR was 0.5% (NAPC, 2010)[235]. From economical point of view these changes will have a major role in increasing the supply and decreasing the prices. Moreover, the GAFTA agreement leads to the improvement of the revenues of Syrian agricultural products into Arabic markets. It is worthy to be mentioned that due to the stimulants provided to some agricultural commodities, the prices of these products increased in the domestic market, (NAPC, 2011).

On the other hand, the EU is the second trade partner with Syria with regard to agricultural products. The economic relations between Syria and EU are controlled by an agreement was signed in 1977. This agreement gave Syria advantages to export industrial products with complete tariff exemption; also it gave tariff exemption for some of the Syrian agricultural products and an exemption for a limited period for some others. However, this agreement did not lead to remarkable developments in the trade relations between the two sides in agriculture. In November 1995 Syria attended the Barcelona meeting which aimed to establish partnership relations between EU and Mediterranean countries to attain a free trade area in 2010. Between 1996 and the beginning of 1998 a lot of exploratory rounds were hold between the Syrian government and the EU which aimed to recognize the regulations and laws at both sides. The formal negotiations started in May 1998 in Brussels and ended in the twelfth round in December 2003 in Damascus. In October 2004, the Syrian-EU Association Agreement SEAA was initialed in Brussels. The final signing was supposed to be during the first three months of the year 2005 and the SEAA will be applied after the final ratification by the parliament in Syria and Europe and the transitional agreement which contain the economical part. The cooperation with the EU will start 60 days after the ratification by the Syrian parliament[236]. Unfortunately, till now, the SEAA has not been signed formally due to political problems[237].

[235] See appendix 25.

[236] Seminar about ‘Agriculture in the Syrian-EU Association Agreement’ was conducted jointly by Mr. Atieh El Hindi, Director of the National Agricultural Policy Center (NAPC) and Mr. Loic Lallemand Zeller, Counselor for Economic and Political Affairs at the EU Delegation in Syria, on 23 March 2005 at the Center’s premises.

[237] In October 2009, the Syrian government told the European Union through the Minister of Foreign Affairs Walid Al-Moallem her refusal to sign the Association Agreement on the date set by the European Union on October 26, 2009. The EU approval came after Syrian government and the EU signed in initials the amended

The agricultural negotiations included two important subjects, the economical one (the trade) and the scientific and technical cooperation. According to the SEAA, an exemption of the custom charges for certain amounts of European products will be provided under the condition that their prices are not less than the prices of domestic products. Vice versa a lot of Syrian products will be exempted from custom duties and given quotas in order to facilitate its access to the EU countries, especially the Syrian vulnerable agricultural commodities (olive oil, citrus, grape, apple, potato and tomato). With regard to Syrian citrus fruits the SEAA gave tariff exemption for 45,000 tons of Syrian citrus fruits and for open quantities of grapefruit. This quota will be increased by 3% annually over three years, and when the quota is exceeded, a tariff reduction by 40–60% is applied. Conversely, the SEAA gave 2,250 tons of European citrus fruits a full tariff exemption. The SEAA will facilitate trade flows. Also, the EU will provide the needed assistance and Syria will adjust its economy to be able to apply the new requirements and to enhance the capacity of government bodies and economic institutions to take advantages of the agreement and to deal with the possible implementation challenges (Alvarez-Coque, 2001; NAPC, 2001).

The Syrian government is doing great efforts to enhance the possibility of opening new markets for Syrian exports through bilateral agreements which are held with several commercial partners. It has also accomplished a formal application to join the WTO[238] (NAPC, 2001).

4.4.4.1 Syrian citrus exports

Table 45 shows that the rate of the Syrian citrus fruits contribution to the total agricultural exports value increased by 28% between 2003 and 2009, while the contribution rate of grapes and some chosen fruits grew by 15% and 12% respectively. This is primarily due to the large increase in the production of citrus fruits during the studied period, which positively influenced the available surplus for export.

text of the Association Agreement in December, 2008; after freezing the convention since 2004 due to political reasons. URL: http://syria-news.com/readnews.php?sy_seq=102990.

[238] On the 4th of May 2010, Syria was accepted as an observer member in the WTO.

Table 45: The contribution of Syrian citrus exports (Oranges – Lemons – Mandarins) to the total agricultural exports; Unit: in %

	Average 00-02	2003	2004	2005	2006	2007	2008	2009	AAGR 03-09 (in %)
Citrus	2.1	0.9	0.6	0.9	0.7	0.4	1.5	3.9	**28**
Grapes	2.1	0.4	0.2	0.3	0.2	0.3	0.1	0.9	**15**
Chosen Fruits	4.4	2.8	1.8	2.6	4.1	2.2	1.3	5.4	**12**
Total Agricultural Exports	100	100	100	100	100	100	100	100	**0**

Source: Own table based on (CBS, Several Issues)

Table 46 illustrates that the Syrian citrus exports increased significantly during 2000-2009 in quantity and value. The exported quantities increased by 24% and the value of citrus exports increased by 21% between 2000 and 2009[239]. In the other hand, the average export was 41 thousand tons valued at 20.5 million US$ during 2000-2002 while the average export during 2007-2009 was 146.7 thousand M.T. valued at 63.1 million US$. However, the export unit value declined from 502.1 $/M.T. to 397.7 $/M.T. over the same periods.

Table 46: The evolution of Syrian citrus exports (Oranges –Lemons – Mandarins) and the main destinations during 2000-2009; Unit: quantity per 1000 M.T., value in million $, and exporter destination

Year	Exports Quantity	Exports Value	Unit Value $/M.T.	Export Destination (%)
Average 00-02	41	20.5	502.1	
Average 07-09	146.7	63.1	397.7	
2005	54.1	9.7	180.3	Iraq 37.8, Jordan 27.6, Saudi Arabia 13.4, Lebanon 6.6, Kuwait 4.9, UAE , 2.1
2006	76	16.5	217.7	Jordan 55.9, Saudi Arabia 23.6, Kuwait 7.7, UAE 3.3, Iraq 2.5
2007	42.1	11.9	281.8	Jordan52.6, Iraq 34.2, Saudi Arabia 5.9
2008	128.2	62	483.3	Iraq37.6, Jordan 28.2, European Markets 9.4, Turkey 8.9, Saudi Arabia 5.4
2009	269.8	115.5	428.1	Iraq 87, Jordan 10.24, Saudi Arabia 1.07

Source: Elaborated from (AASA, 2010) and the database of General Custom Directorate 2000-2004 in addition to CBS database between 2005 and 2010

239 Own calculation, based on Table 43 and Table 46.

Table 46 shows that the main destinations of Syrian citrus fruits exports are the Arab countries as a result of GAFTA. At the same time, the transportation between GAFTA countries is characterized by low costs which allow Syrian citrus products to compete effectively within these markets, especially in the neighbor countries like Iraq and Jordan. They constituted in 2009 the main export destination countries for Syrian citrus fruits with 87% and 10.24% respectively.

4.4.4.2 Syrian citrus imports

The Syrian government has banned the import of citrus fruits from all countries except from Arab countries and Turkey, due to the free trade agreements which were signed with Arab countries and Turkey. Also Syria is not considered an importing country of citrus fruits as it is a self-sufficient country and it is producing surpluses. However, the Syrian adoption of free trade policies has allowed importing citrus in 2001 in little quantities up to 7,000 tons. This quantity increased as a result of implementing the GAFTA to reach 39,000 tons in 2009 (Table 43). Lebanon was the main importing country for citrus fruits to Syria (NAPC, 2010).

4.5 Government policies affecting the citrus sector in Syria

According to interviews with some experts and official employees who are working directly or indirectly within the citrus sector in Syria[240], the Syrian government policies which affect the citrus sector could be divided as follows:

1. Policies related to production: Since 1992 the Syrian government has applied the biological control programs in order to decrease production cost and to produce special, clean, and free of chemicals fruit. The Ministry of Agriculture and other concerned authorities have offered also all necessary support to enhance both quality and quantity of citrus in Syria. The great expansion that happened in the last twenty years was a result of a lot of efforts done by the government to develop the production of citrus which has become one of the most important crops. These efforts can be summarized as following:

    - Introducing high yielding varieties and supporting programs for land reclamation.

[240] The surveyed persons included some wholesalers, exporters, packers within fruit and vegetable markets and some large growers in addition to experts and official employees in the SMAAR and Ministry of Trade and Economy and their research bodies.

- Cultivating supported seedlings in governmental nurseries.
- Providing the necessary requirements, extension services, and the Integrated Pest Management programs (IPM).

These procedures, which have been accompanied by high prices of domestic citrus fruit, have enhanced their produce and the profitability.

The production planning system has contributed to a great extent to the expansion of citrus cultivation. Credits are provided by the Agricultural Cooperative Bank (ACB) in order to enhance citrus production, to encourage farmers to use new irrigation systems and to improve the quality of citrus and to serve citrus groves by public irrigation nets for low and subsidized prices. Furthermore, as a result of the recommendations proposed by the Ministry of Agriculture and Citrus Bureau, the government issued in 1987 a resolution that bans the importation of orange seedlings, which was one of many resolutions issued for the sake of enhancing citrus production.

2. Policies related to processing: Import taxes are imposed on imported orange concentrates (29% for the concentrate of orange juice used for the industry and 102% for the concentrate used for orange juice). The members of the Great Arab Free Trade Area (GAFTA) have been exempted from paying these taxes since 2005.
3. Policies related to transportation: The Ministry of Economy and Trade issued on 18 May 2002 resolution No. 672 which illustrates that all private importers are allowed to import used freezing cars and trailers either from original or non-original countries under some conditions like year of head manufacturing is not exceeding five years (including the year of manufacturing). Foreign currency earnings from exporting fruit and vegetables can be used as payments for these cars[241].
4. Policies related to trade: A lot of procedures and instructions have been introduced to facilitate export such as:
   - Exempting agricultural exports from agricultural production and income taxes[242].
   - Eliminating the procedures of compensating the value of imports from foreign currency earned. Another privilege that exporters can make use of is the ability to keep 100% of their foreign currency earnings from exporting fruit and vegetables. They are free to do whatever they want concerning their

[241] Imported used freezing trailer should be as one join unit (head of engine with its body).

[242] Legislative decree No. 15 issued on 3 July 2001.

exportation returns like selling them through the Commercial Bank of Syria as the prices of circulating currencies in the neighboring countries for non-commercial transactions. In the same way, through the Commercial Bank of Syria they can sell them to other traders or cover the value of imports[243].

- To encourage the industrial private sector and to reduce the transportation cost the legislative decree No. 48 has been issued on 4 August 1998. This legislative decree declares that Syria joined the TIR Treaty[244]. Consequently, the imposts on the Syrian tracks were reduced.
- The Ministry of Transportation issued on 24 September 2001 the generalization No. 17854 to allow Turkish tracks into Syria in order to freight Syrian fruit and vegetables to Western European countries.
- The Syrian-European Association Agreement.
- The import of orange was banned on 4 August 1981 through the resolution No. 1466 issued by the Syrian Prime Minister. However, after joining GAFTA in 1998 Syrian traders began importing and exporting their products according to the agricultural calendar of GAFTA members.
- Other reforms in the agricultural trade policies includes permitting of importing formerly banned products like some tropical fruit concentrates (resolution No. 7207 that issued by Ministry of Economy and Trade in 2003)
- Private exporters of fruit and vegetable are allowed to import used lines of packing and waxing, stipulated that manufacturing year is not exceeding four years.
- Export is opened to private exporters and exported agricultural products, with their containers, are exempted from taxes. Furthermore, exporters are compelled to put labels on exported products explaining product characteristics, name of the company, and the address of the factory. In addition, exporters are committed to declare that all the exported products are controlled according to the standard characteristics in destination countries.

[243] The resolution No. 1100 issued by Ministry of Economy and Trade on 15 July 2003.

[244] The Convention on International Transport of Goods Under Cover of TIR Carnets (TIR Convention) was made at Geneva on 14 November 1975 to simplify and harmonize the administrative formalities of international road transport. The TIR Convention or International Road Transport Convention was adopted under the auspices of the United Nations Economic Commission for Europe (UNECE).

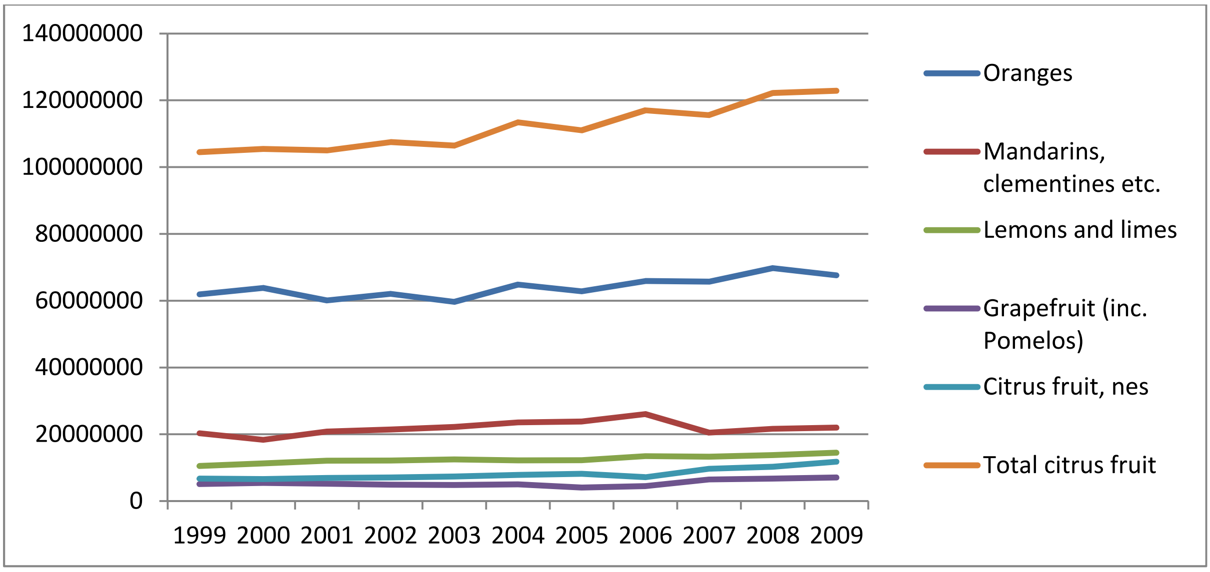
5. Supply chain analysis of the fresh citrus fruits market in the EU

5.1 World market of citrus fruit

5.1.1 World production

According to the Food and Agriculture Organization Statistical database (FAOSTAT) in 2010, total citrus fruit production accounted for nearly 20% of the world production of fruit between 1999 and 2009. However, it increased slightly by 1.6% during the same period[245] from about 104.5 million tons in 2009 to approximately 122.8 million tons in 2009 (Figure 31).

Figure 31: Citrus fruit world production during 1999-2009 by product; Unit: M.T.



Source: Own figure based on (Appendix 26)

In 2009 oranges production accounted for nearly 55% of total citrus production, equivalent to 67.6 million tons approximately. Its AAGR during 1999 and 2009 was 0.9%. The mandarins group[246] represented about 17.9% of total citrus fruit production in 2009, and its production increased very slightly by 0.8% from about 20.3 million tons in 1999 to 22 million tons in 2009. Lemons and limes production grew by 3.3%, over the same period, from 10.5 million tons in 1999 to 14.5% in 2009. It constituted about 11.8% of total citrus production in the same year.

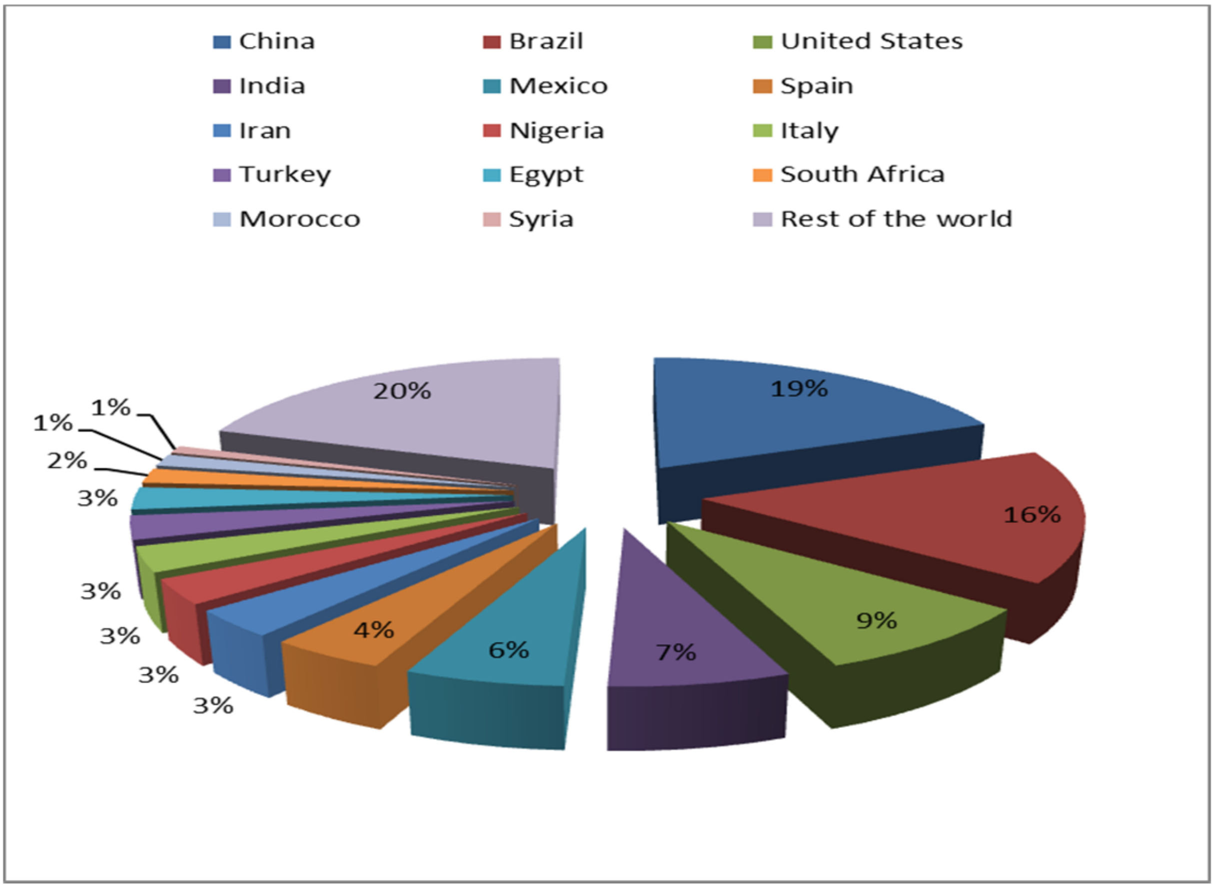
[245] All the AAGR percentages were calculated by researcher based on appendix 26.

[246] It includes mandarins, clementine, tangerines etc.

Other citrus fruit[247] products accounted for 9.6% of production in 2009 and their production increased by 5.8% from about 6.7 to 11.8 million tons during 1999-2009. Grapefruit production[248] accounted for 5.7% in 2009; its production increased by 3.3% from about 5.1 to 7 million tons during the same period (Figure 31)[249].

Citrus fruits are produced in nearly 104 countries with 70% of production centered particularly in Brazil, Mediterranean countries, the United States, and China (Figure 32).

Figure 32: World citrus fruit production in 2009 by country; Unit: %



Source: Own figure based on (Appendix 27)

Table 47 illustrates the most important countries in producing the different types of citrus fruits over the world in 2009/10.

247 It means citrus fruit, nes.

248 It includes pomelos.

249 All citrus fruit products' share from the total citrus fruit production were calculated by researcher and based on appendix 26.

Table 47: Main producer countries of citrus fruit in 2009/2010 by product; Unit: % of total world production

	Country
Oranges	Brazil 31.8%, United States 15.4%, China 13.4%, EU12.9%, Mexico 8.4%, other countries 18.1%
Mandarins group	China 65%, EU 14%, Japan 5.1%, Turkey 3.9%, Morocco 2.9%, other countries 9.1%
Lemons and limes	Mexico 31.8%, EU 19.5%, Argentina 16.8%, Turkey 13.2%, United States 13.4%, other countries 5.4%
Grapefruits and pomelos	China 53.4%, United States 20.7%, South Africa 6.3%, Mexico 7.4%, Turkey 3.5%, other countries 8.8%

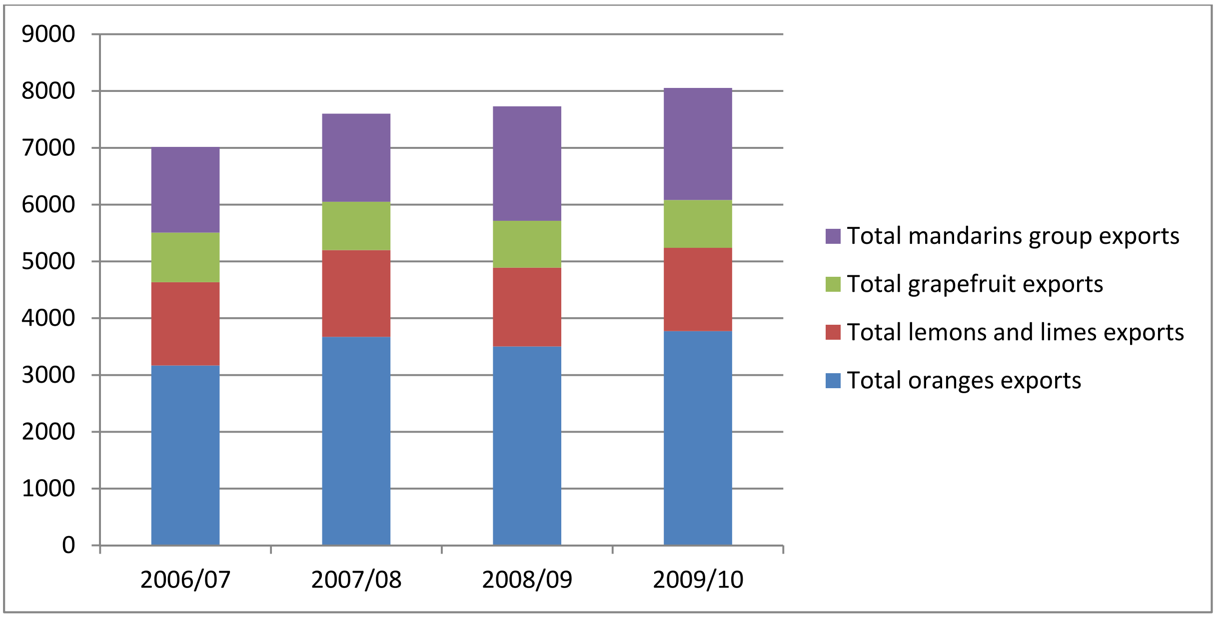
Source: Own table based on (USDA, 2012)

5.1.2 World trade in citrus fruit

5.1.2.1 World exports

Figure 33 shows that the total world exports of grapefruit and lemons decreased very slightly by approximately 1.2% and 0.1% respectively between 2006/07 and 2009/10. However, the total world exports of citrus fruit increased due to the clear increase in total world exports of oranges and mandarins group by 6% and 9.4% respectively during the same period[250].

Figure 33: World exports of citrus fruit during 2006/07-2009/10 by product; Unit: 1000 M.T.



Source: Own figure based on (USDA, 2012)

[250] See appendix 28.

In 2009/10 South Africa was the main exporter of oranges in the world with 27.7%, followed by Egypt with 22.5% and the United States with 17.7%. The exports of these three countries accounted for more than 50% of total orange world exports. Other main exporters of other citrus products fruits are illustrated in Table 48.

Table 48: Main citrus fruit exporting countries in 2009/2010 by product; Unit: % of world exports

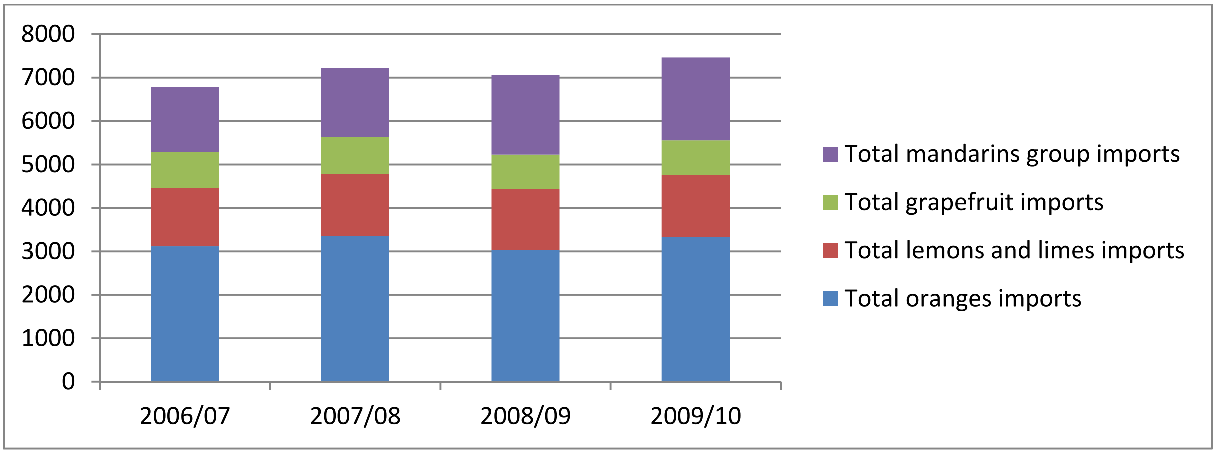
	Country
Oranges	South Africa 27.7%, Egypt 22.5%, United States 17.7%, EU 7.2%, Turkey 5.5%, other countries 19.3%
Mandarins group	China 36.1%, Turkey 16.7%, Morocco 16.4%, EU 13.5%, South Africa 5.7%, other countries 11.6%
Lemons and limes	Mexico 30.6%, Turkey 29.6%, Argentina 18%, South Africa 9.9%, United States 6.3%, other countries 5.6%
Grapefruits and pomelos	United States 28.8%, South Africa 22.2%, Turkey 18.3%, China 14.2%, Israel 10%, other countries 6.5%

Source: Own table based on (USDA, 2012)

5.1.2.2 World imports

The total world imports of citrus fruit increased due to the obvious increase in total world imports of oranges, mandarin group, and lemons by 2.2%, 8.6%, and 2.2%, respectively during 2006/07-2009/10. The total world imports of grapefruit decreased slightly by 1.5% over the same period[251] (Figure 34).

Figure 34: World imports of citrus fruit during 2006/07-2009/10 by product; Unit: 1000 M.T.



Source: Own figure based on (USDA, 2012)

[251] See appendix 29.

In 2009/10 EU countries were the main importers of oranges in the world with 28.8%, followed by Russia with 14.4% and Saudi Arabia with 8.4%. During the same year, the EU countries imported nearly 49% of total world production of grapefruits and pomelos. The EU, the US, and Russian imports of lemons and limes accounted more than 75% of total lemon world imports. Table 49 shows the other main importers of other citrus products fruits.

Table 49: Main citrus fruit importing countries in 2009/2010 by product; Unit: % of world imports

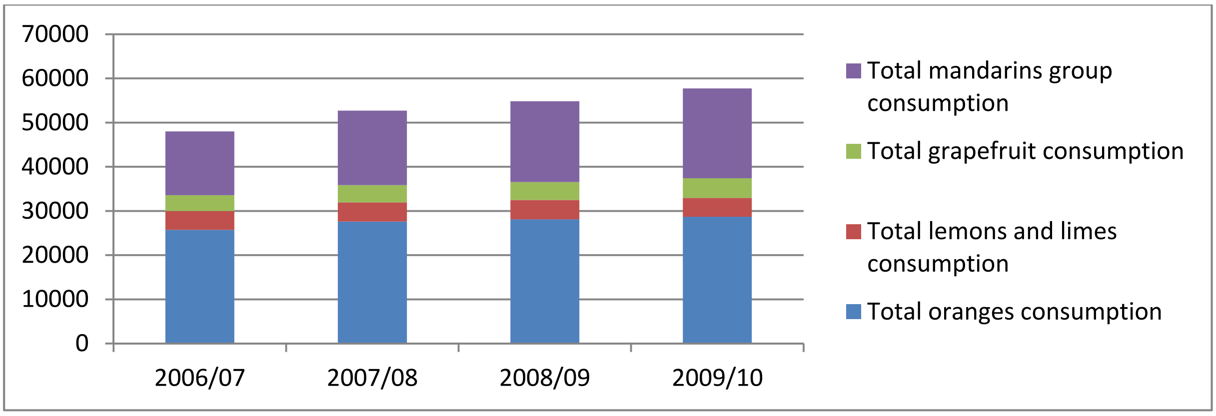
	Country
Oranges	EU 28.8%, Russia 14.4%, Saudi Arabia 8.4%, Canada 6.1%, United Arab Emirates 4.5%, other countries 36.5%
Mandarins group	Russia 31.1%, EU 21.9%, Vietnam 10.6%, Indonesia 8.4%, Ukraine 7.6%, other countries 20.6%
Lemons and limes	EU 32.9%, United States 28%, Russia 14.7%, Saudi Arabia 5.9%, Canada 4.5%, other countries 14%
Grapefruits and pomelos	EU 49.1%, Japan 20%, Russia 13.4%, Canada 5.8%, Ukraine 2.7%, other countries 7.8%

Source: Own table based on (USDA, 2012)

5.1.3 World fresh citrus fruit domestic consumption

Figure 35 illustrates that the total world consumption of oranges, grapefruit, and mandarin group increased by 3.7%, 7.6%, and 12.1% respectively during 2006/07-2009/10. China's citrus fruit market witnessed the largest increase in domestic consumption of these three products over the same period[252].

Figure 35: World fresh domestic consumption of citrus fruit during 2006/07-2009/10 by product; Unit: 1000 M.T.



Source: Own figure based on (USDA, 2012)

[252] See appendix 30.

On the other hand, the total fresh consumption of lemons and limes decreased very slightly by 0.1% between 2006/07 and 2009/10. This decline indicates that the main consuming countries of lemons and limes are nearly the same main producing countries, as shown in Table 47 and Table 50.

As presented in Table 50, China was the main consuming country of oranges, grapefruit, and mandarin group in 2009/07. EU countries came into the second place (19.9%, 10.1%, and 13.8% respectively). Regarding lemons and limes EU, Mexico, and the United States consumed more than 70% of the marketed quantities in the same year.

Table 50: Main citrus fruit consumers' countries in 2009/2010 by product; Unit: % of world consumption

	Country
Oranges	China 21.7%, EU 19.9%, Brazil 16.8%, Mexico 11%, United States 4.7%, other countries 25.9%
Mandarins group	China 63.8%, EU 13.8%, Japan 4.9%, Russia 2.9%, United States 2.6%, other countries 11.9%
Lemons and limes	EU 32.7%, Mexico 27%, United States 17.3%, Turkey 6.8%, Russia 4.9%, other countries 11.3%
Grapefruit and pomelos	China 62.9%, EU 10.1%, United States 8.8%, Mexico 6.6%, Japan 3.8%, other countries 7.8%

Source: Own table based on (USDA, 2012)

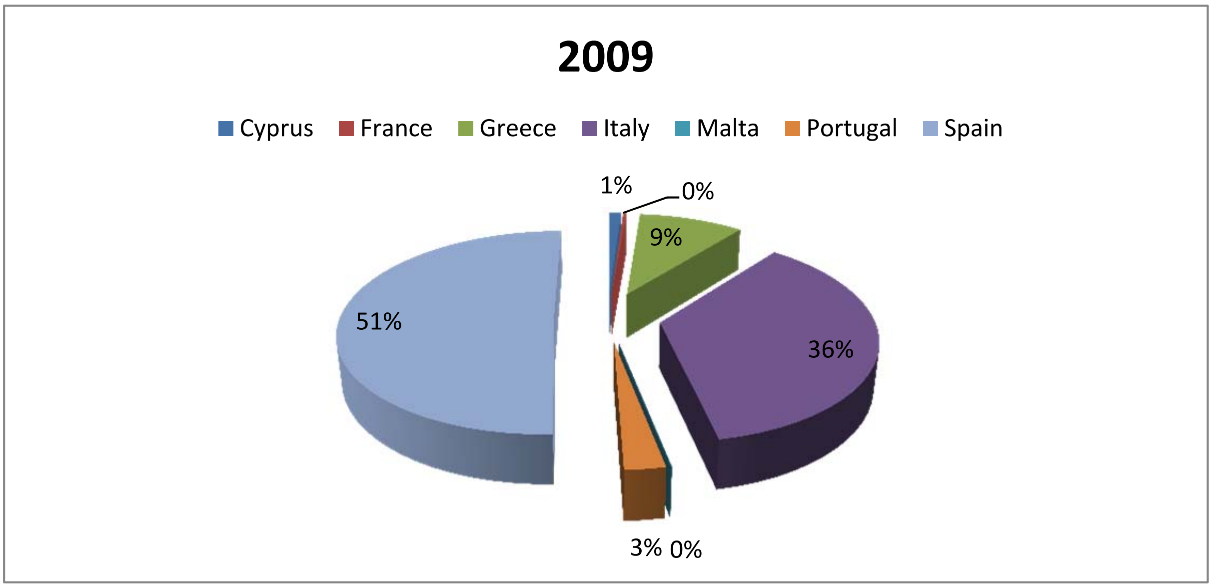
5.2 Citrus fruits market in EU

5.2.1 Citrus fruits production

Citrus fruit production in the EU is regulated by the Common Agricultural Policy (CAP) which is in the process of reform with the aim of improving the competitiveness and market orientation of the fruit and vegetables sector, reducing fluctuations in producers' income, increasing fruit and vegetable consumption and protecting the environment (European Commission, 2007).

The EU is a major producer of fresh citrus fruit. Production is concentrated in seven countries that are characterized by Mediterranean climate which allows higher production levels. These countries are presented in Figure 36.

Figure 36: EU citrus fruits production by country in 2009; Unit: %

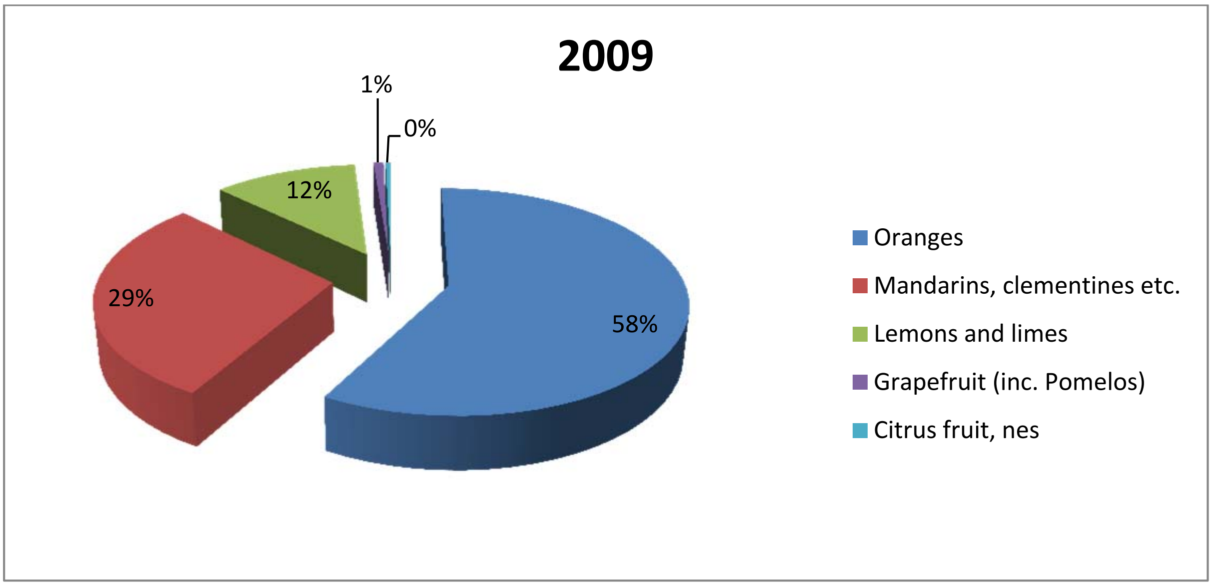


Source: Own figure based on (FAOSTAT, 2011).

As shown in the previous figure, Spain and Italy are the largest producers of citrus fruit in the EU with 51% and 36% of production respectively. The citrus fruit production in Greece constituted only 9% and in Portugal 3%. France and Cyprus produced negligible quantities in 2009.

The total citrus fruit production in the EU, in 2009, amounted to almost 10.9 million tons of which 58% were oranges, 29% mandarin group, and 12% lemons and limes (Figure 37).

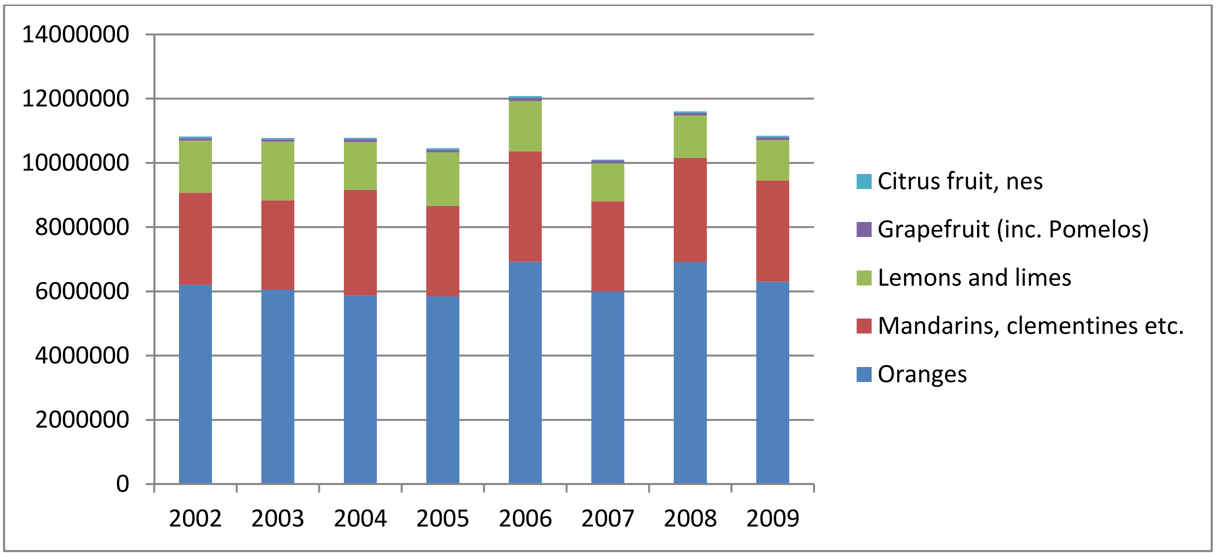
Figure 37: EU citrus fruits production by product in 2009; Unit: %



Source: Own figure based on (FAOSTAT, 2011).

The total production of citrus fruit in the EU fluctuated from year to year between 2002 and 2009 (Figure 38).

Figure 38: Trends in EU citrus fruits production during 2002-2009 by product; Unit: M.T.



Source: Own figure based on (FAOSTAT, 2011)

Over the period between 2002 and 2009, oranges production increased very slightly by 0.2% from about 6.2 million tons in 2002 to 6.3 million tons in 2009. The production of grapefruits increased by 1.7% from about 0.08 million tons in 2002 to 0.09 million tons in 2009. Also production of mandarins group increased during the same period by 1.4% from approximately 2.9 million tons in 2002 to 3.2 million tons in 2009[253].

Table 51: Distribution of citrus fruit production in 2009 by product and country; Unit: % of total EU production

	Country
Oranges	Spain 44%, Italy 39%, Greece 13%, Portugal 3%, Cyprus 1%, France and Malta <1%
Mandarins, clementine etc.	Spain 64%, Italy 28%, Greece 4%, Portugal 2%, Cyprus 1%, France 1%, and Malta <1%
Lemons and limes	Spain 49%, Italy 42%, Greece 7%, Portugal 1%, Cyprus 1%, France and Malta <1%
Grapefruit (inc. Pomelos)	Spain 47%, Cyprus 31%, Italy 9%, Greece 7%, Portugal 2%, France 4%, and Malta <1%
Citrus fruit, nes	Italy 64%, Spain 30%, Greece 3%, Malta 2% Cyprus 1%, and Portugal <1%

Source: Own table based on (FAOSTAT, 2011)

[253] Own calculation based on appendix 31.

Table 51 distributes the production of citrus fruits' products between the producing countries in EU in 2009.

5.2.2 Trade trends in the EU citrus fruits market

5.2.2.1 Citrus fruits imports

In 2009, EU imports of fresh citrus fruit had a value of 4.4 billion €, an increase of about 3% since 2002. Total import volume increased very slightly by 0.8% over the same period, from 6 million tons in 2002 to 6.4 million tons in 2009, approximately. 68% of imports are from one EU country to another (intra-EU trade), while the remaining 32% concern imports from outside of the EU. Extra-EU imports grew more quickly in value than volume. It increased by 3.7% in value while the increase in volume was about 1.2% between 2002 and 2009[254]. Figure 39 illustrates the trends in the EU intra and extra imports by products in 2002, 2006, and 2009.

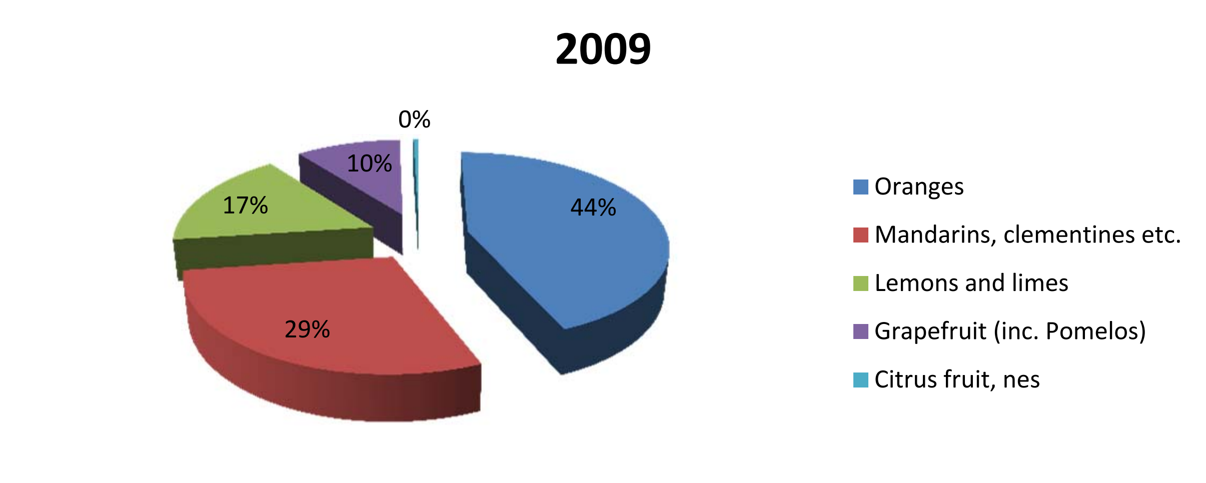
Figure 39: Trends in EU intra and extra imports by products' volume and value in 2002, 2006, and 2009

Source: Own figure based on (Eurostat, 2011)

[254] Own calculation based on appendix 32.

Figure 40 shows the share of major imported citrus fruit products in 2009. 44% of total citrus fruit import volumes were oranges, 29% mandarins group, 17% lemons and limes, and less than 1% from other citrus fruits.

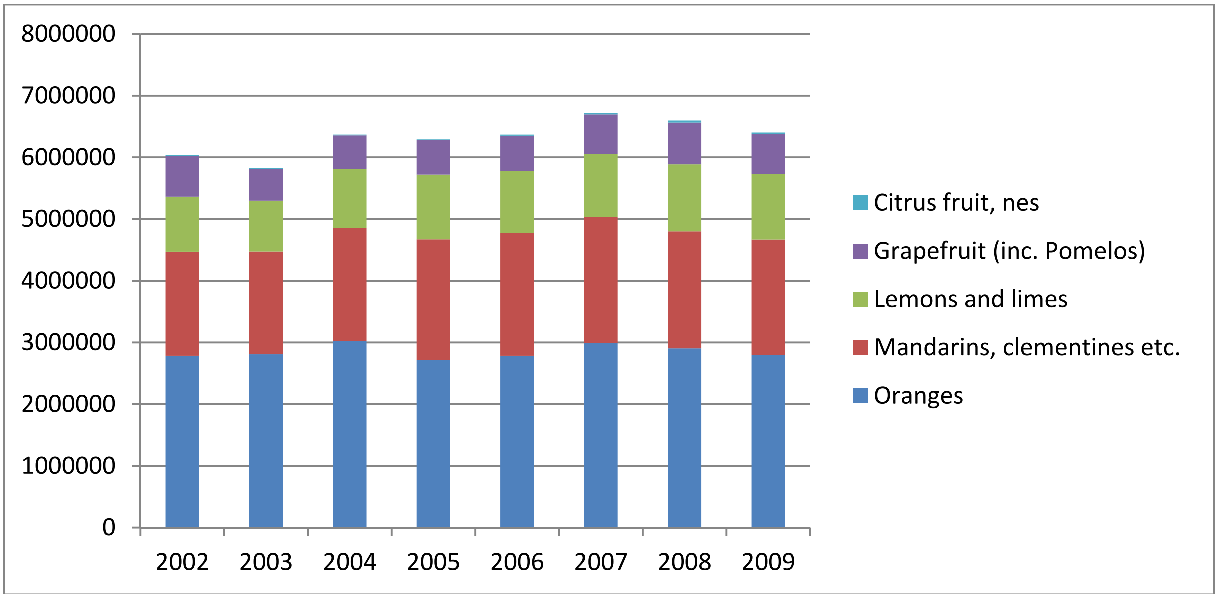
Figure 40: EU citrus fruits imports quantities by product in 2009; Unit: %



Source: Own figure based on (Eurostat, 2011)

In 2009, compared to 2002, imports of (citrus fruit, nes) increased by 8%, followed by lemons and limes by 2.6%, mandarins group by 1.5%, and a very negligible increase by 0.07% for oranges. However, imports of grapefruits decreased by 0.4% during the same period (Figure 41)[255].

Figure 41: Trends in EU citrus fruits imports during 2002-2009 by product; Unit: M.T.



Source: Own figure based on (Eurostat, 2011)

255 Own calculation based on appendix 33.

Table 52 provides information about the share of major importers per product and the differences between EU countries.

Table 52: Share of citrus fruit import quantities in 2009 by product and country; Unit: % of total EU imports volume

	Country
Oranges	Germany 18%, the Netherlands 17%, France 16%, UK 10% Italy 7%, Belgium 5%, Spain 4%, Poland 4%, and the rest of EU countries 19%
Mandarins, clementine etc.	Germany 20%, France 18%, UK 14%, the Netherlands 10%, Poland 8%, Italy 5%, and the rest of EU countries 25%
Lemons and limes	The Netherlands 15%, Germany 13%, France 13%, Italy 10%, Poland 10%, UK 9%, and the rest of EU countries 32%
Grapefruit (inc. Pomelos)	The Netherlands 26%, Germany 13%, France 11%, Belgium 8%, UK 6%, Poland 7%, Italy 5%, and the rest of EU countries 24%
Citrus fruit, nes	Denmark 34%, Germany 16%, Czech Republic 11%, France 7%, and the rest of EU countries 32%

Source: Own table based on (Eurostat, 2011)

Germany is the largest importer of fresh oranges and mandarin group between the EU member countries. In 2009, Germany accounted for 18% and 20% respectively of the total EU import volume of oranges and mandarins group. Regarding grapefruits and lemons, the Netherlands was the largest importer by 15% and 26% of the total EU import volume respectively; followed by Germany and France. The Netherlands play an important role in the intra EU trade of fresh citrus fruits. Its domestic market is relatively small and most of the imports are re-exported to other EU countries and outside of the EU. Poland is the leading fresh citrus fruit importer among the ten new EU member countries, followed at a distance by the Czech Republic and Hungary. These imports are small compared to the huge quantities imported by the EU-15 countries, but they show a stronger growth[256].

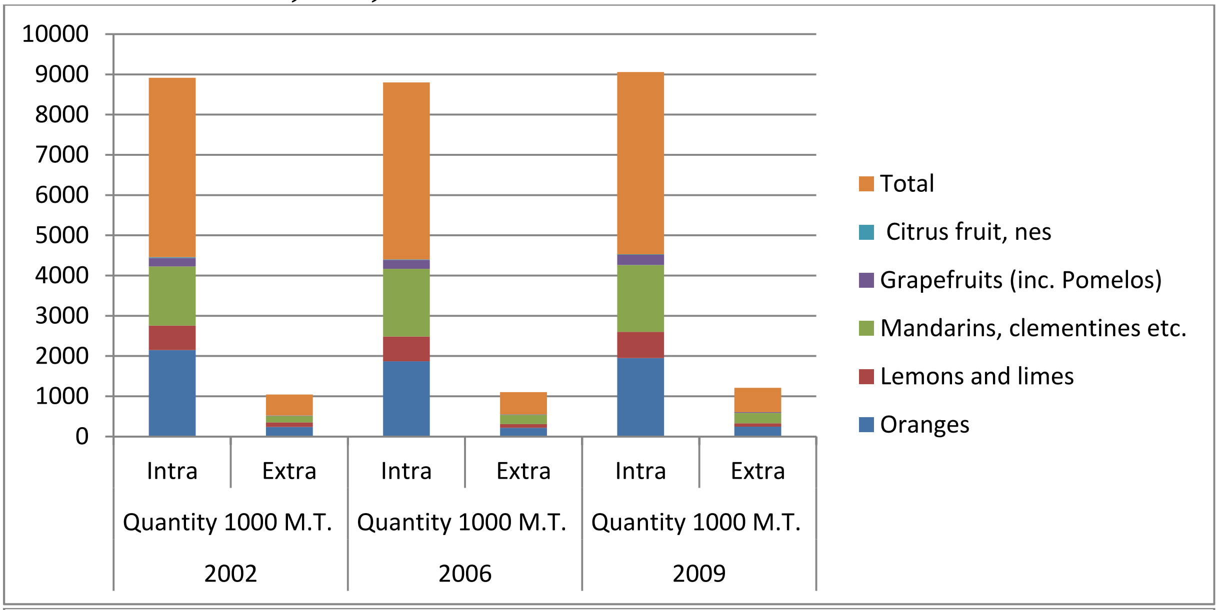
5.2.2.2 Citrus fruits exports

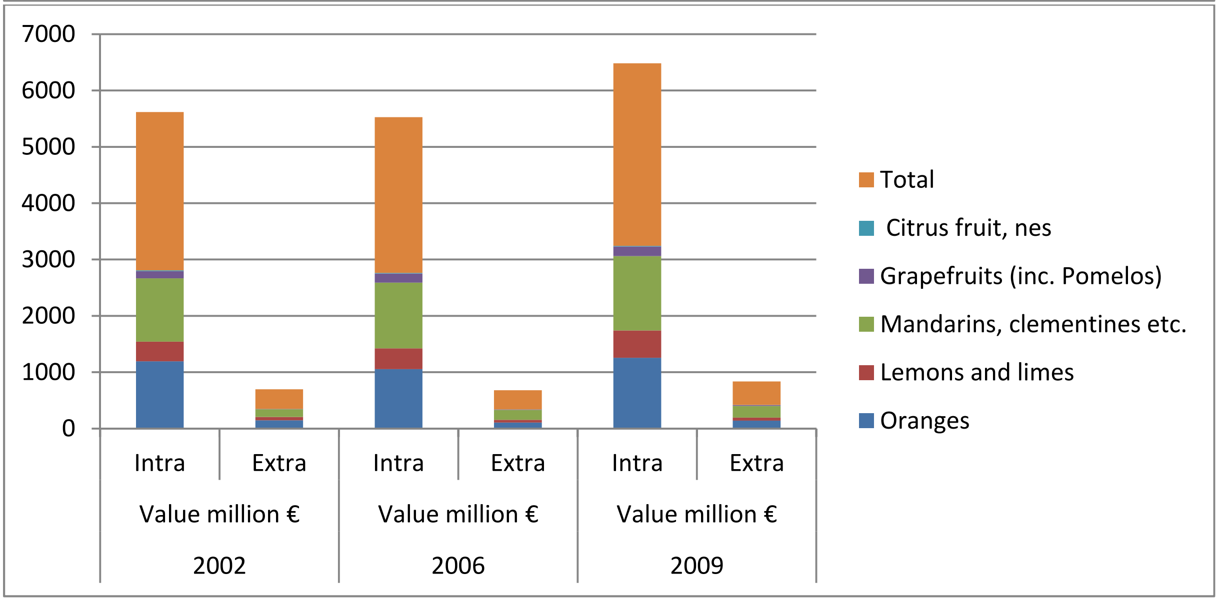
In 2009, EU exports of fresh citrus fruit were 3.7 billion € and 5.1 million tons, constituting a growth of 2.1% in value and 0.4% in volume since 2002. Most of the exports go to other EU

[256] See appendix 34.

countries (89% of total EU export value). The countries with the largest citrus fruit exports are the Netherlands, Spain, and Greece[257]. The Netherlands are the largest re-exporter of citrus fruit from developing countries while Spain and Greece are the largest exporter of domestic citrus fruit. Intra-EU exports grew more quickly in value than volume. They increased by 2.1% in value while the increase in volume was very negligible by 0.2% between 2002 and 2009[258]. Figure 42 illustrates the trends in the EU intra and extra exports by products in 2002, 2006, and 2009.

Figure 42: Trends in the EU intra and extra exports by products' volume and value in 2002, 2006, and 2009





Source: Own figure based on (Eurostat, 2011)

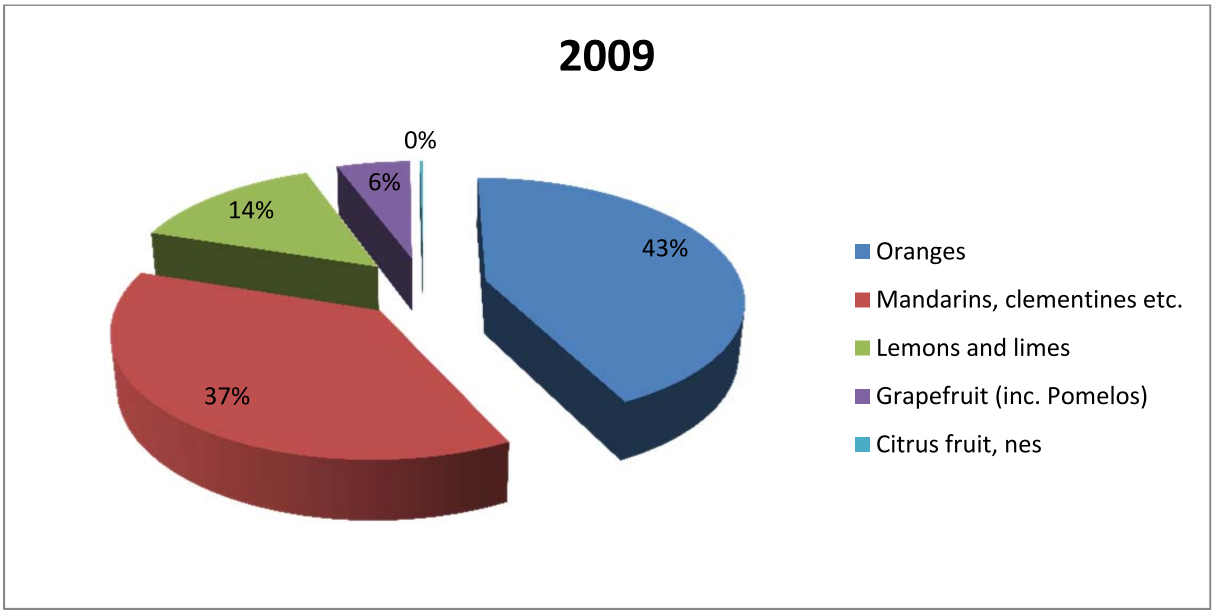
[257] See appendix 37.

[258] Own calculation based on appendix 35.

EU countries witnessed a sharp growth in re-exports and transit trade for citrus fruits between 2002 and 2009 as a result of increasing trade internationalization. The opening of new markets in Eastern Europe has also contributed to the increase in re-exports. The Netherlands, Lithuania, Poland, the United Kingdom, and the Czech Republic account for a large share of their exports and transit trade, but re-exports from Belgium, France, and Germany are gaining importance[259].

The shares of major exported citrus fruit products in 2009 are presented in Figure 43. Orange exports constituted about 43% of total citrus fruit export volume, mandarin group 37%, lemons and limes 14%, grapefruits 6%, and less than 1% for other citrus fruits.

Figure 43: EU citrus fruits exports quantities by product in 2009; Unit: %



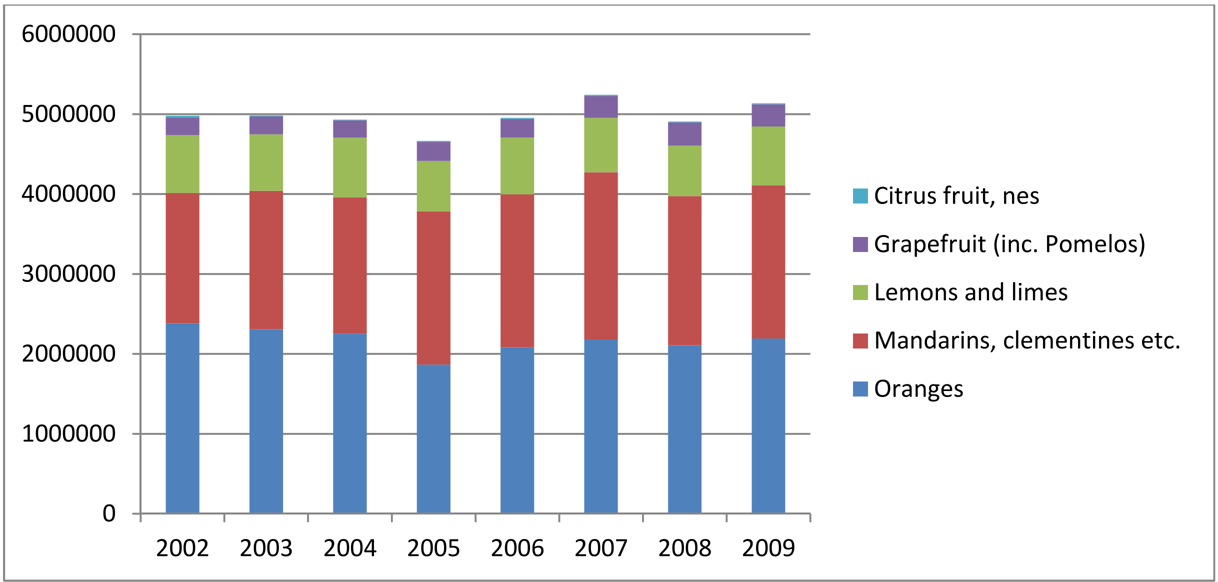
Source: Own figure based on (Eurostat. 2011)

The exports of grapefruits increased by 3.4% during 2002 and 2009, while exports of mandarin group increased by 2.4%. At the same time exports of lemons and limes increased very slightly by 0.2%. However, citrus fruit, nes decreased by 8.8% accompanied with a decline in orange exports by 1.2% during the same period (Figure 44)[260].

[259] See appendix 37.

[260] Own calculation based on appendix 36.

Figure 44: Trends in EU citrus fruits exports during 2002-2009 by product; Unit: M.T.



Source: Own figure based on (Eurostat. 2011)

Table 53 illustrates the share of major exporters per product and the differences between EU countries.

Table 53: Share of citrus fruit export quantities in 2009 by product and country; Unit: % of total EU exports volume in M.T.

	Country
Oranges	Spain 65%, Greece 12%, the Netherlands 9%, Italy 4%, and the rest of EU countries 10%
Mandarins, clementine etc.	Spain 77%, the Netherlands 5%, Italy 5%, Greece 3%, France 2%, and the rest of EU countries 8%
Lemons and limes	Spain 64%, the Netherlands 15%, Italy 5%, Belgium 3%, Germany 2%, and the rest of EU countries 11%
Grapefruit (inc. Pomelos)	the Netherlands 44%, Belgium 17%, Spain 14%, Austria 5%, Germany 4%, Cyprus 4, Slovenia 3%, Italy 2%, Lithuania 2%, and the rest of EU countries 5%
Citrus fruit, nes	the Netherlands 67%, Spain 7%, Greece 5%, Belgium 4%, Italy 3%, Czech Republic 3%, Germany 2%, and the rest of EU countries 9%

Source: Own table based on (Eurostat. 2011)

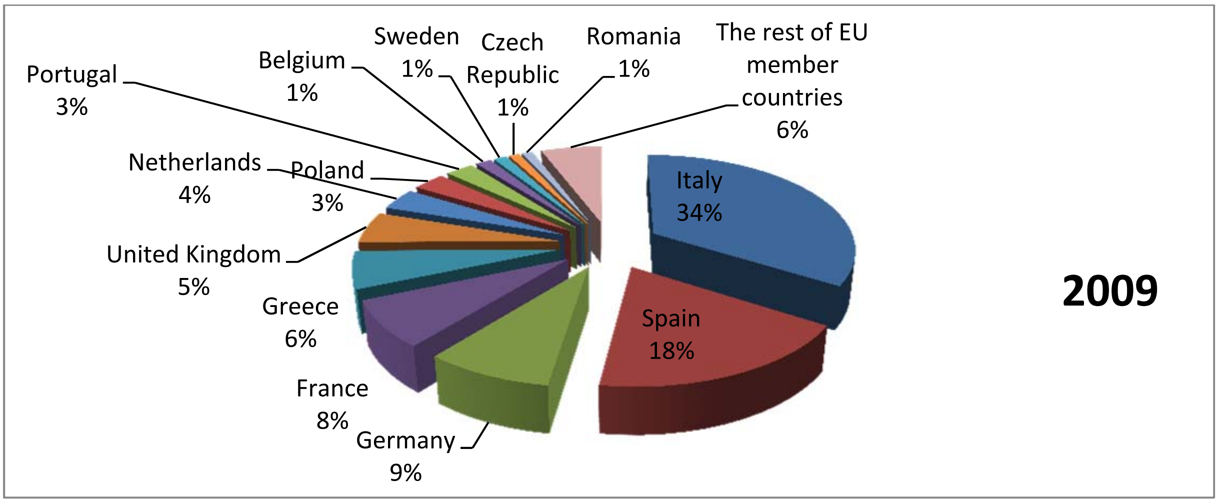
Spain, which is the main citrus fruits producer in the EU, is also the largest exporter of fresh oranges and mandarin group and lemons among the EU member countries, (Table 51). In

2009, Spain accounted for 65%, 77%, and 64% respectively of the total EU export volume of oranges, mandarins group, and lemons and limes. However, the Netherlands was the largest re-exporter of grapefruits and (citrus fruit, nes) by 44% and 67% of the total EU export volume respectively. The Netherlands imports large quantities of citrus products and then it re-export[261] them to other EU countries and outside the EU[262].

5.2.3 Citrus fruit consumption in the EU market

In 2009, consumption[263] of fresh citrus fruit in the EU was 12.11 million tons. The total consumption of citrus fruit grew negligibly by 0.3% during 2002-2009[264]. There are large differences in citrus fruits consumption between the EU member countries. Italy and Spain have the largest volumes of consumption; together they accounted for 52% of the total EU market in 2009 (Figure 45).

Figure 45: EU citrus fruits consumption by country in 2009; Unit: %



Source: Own figure based on (Appendix 39)

[261] In case of re-export, citrus fruit products are declared at the national Customs, whereas for transit trade the products enter the country without formal declaration at Customs. However, only in the final destination country products will be declared, (CBI, 2009). CBI: (Centre for the Promotion of Imports from developing countries) is the agency of the Ministry of Foreign Affairs of the Netherlands. CBI's mission is to contribute to sustainable economic development in developing countries through the expansion of exports from these countries. More information on the official website: http://www.cbi.eu/5/about_cbi.

[262] See appendix 37.

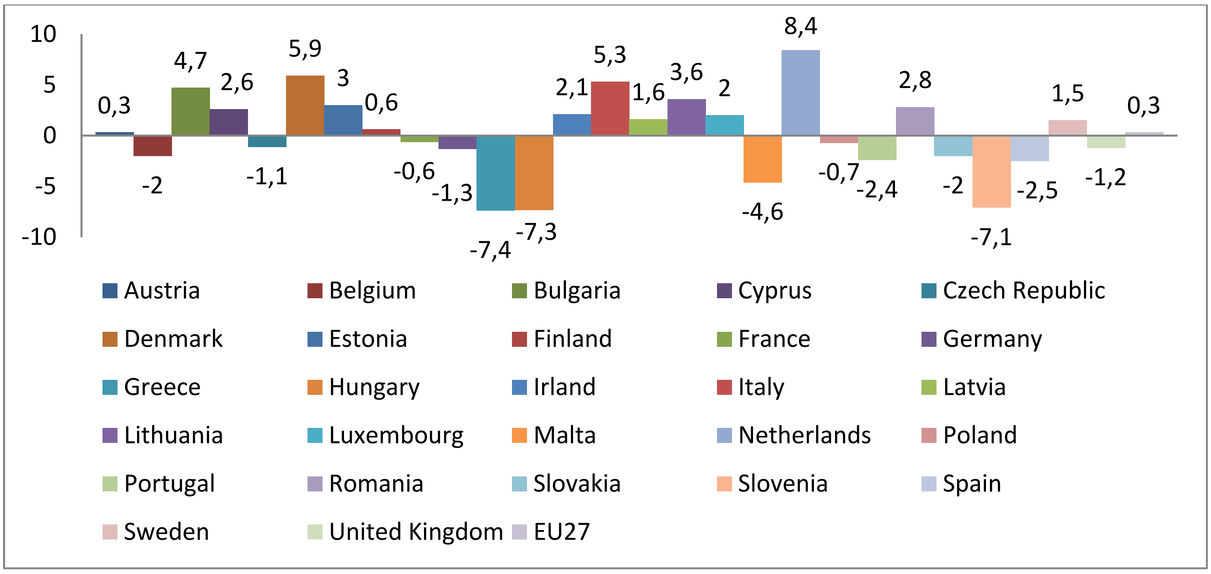
[263] Consumption = Gross Supply = Total Production + Total Imports – Total Exports. Gross supply means: net home grown and imported minus exported citrus fruits.

[264] See appendix 38.

Spain and Italy are also the largest producers of citrus fruits. Germany, France, Greece, and United Kingdom have large volumes of consumption comparison to the rest EU member countries. However, Germany and United Kingdom are non-producer countries for citrus fruit therefore they rely heavily on imports. In general, citrus fruit products are increasingly available throughout the year, in a shift from the traditional seasonal patterns.

Consumption volumes of citrus fruit products were stable or even declined between 2002 and 2009 within most of the old member states of the EU. However, in the new member states, especially in the eastern countries, the situation is more diverse since consumption patterns are changing fast towards a Western European style. Germany, Spain, Italy and France have large markets of citrus fruit products, which are, in very general terms, close to saturation. Within the EU market, the Netherlands, Denmark, Bulgaria, Italy, Lithuania, and Estonia saw their markets growing (Figure 46)

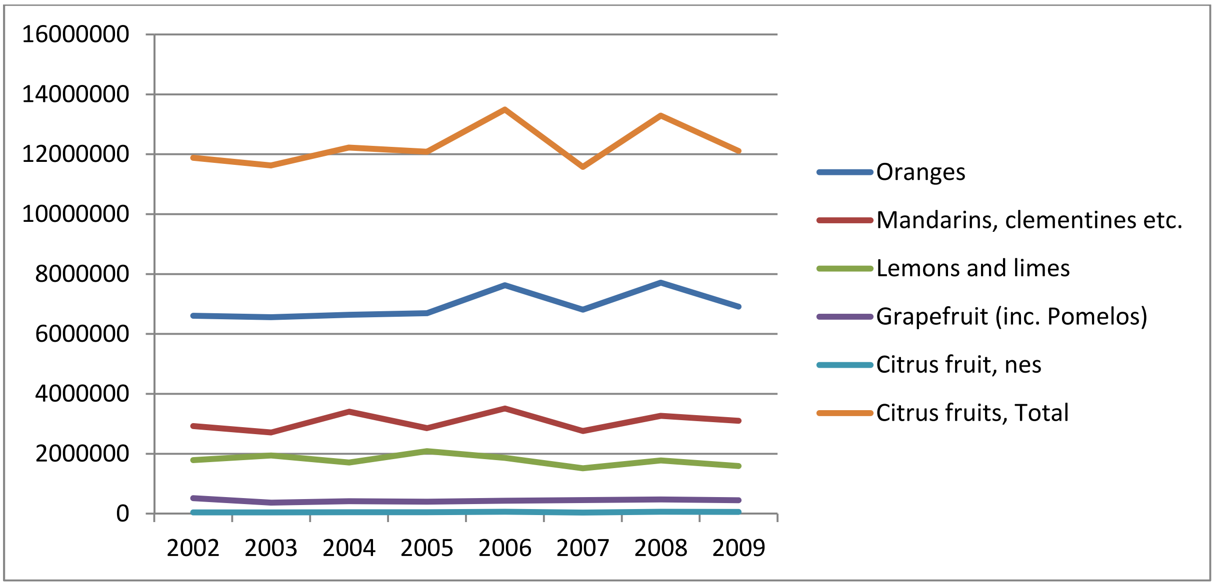
Figure 46: The AAGR of EU citrus fruits consumption during 2002-2009 by country; Unit: %



Source: Own figure based on (Eurostat, 2011)

Figure 47 shows that the gross supply of citrus fruit products stayed almost steady during studied years. Furthermore, the consumption of oranges and mandarins group fluctuated during 2002-2009.

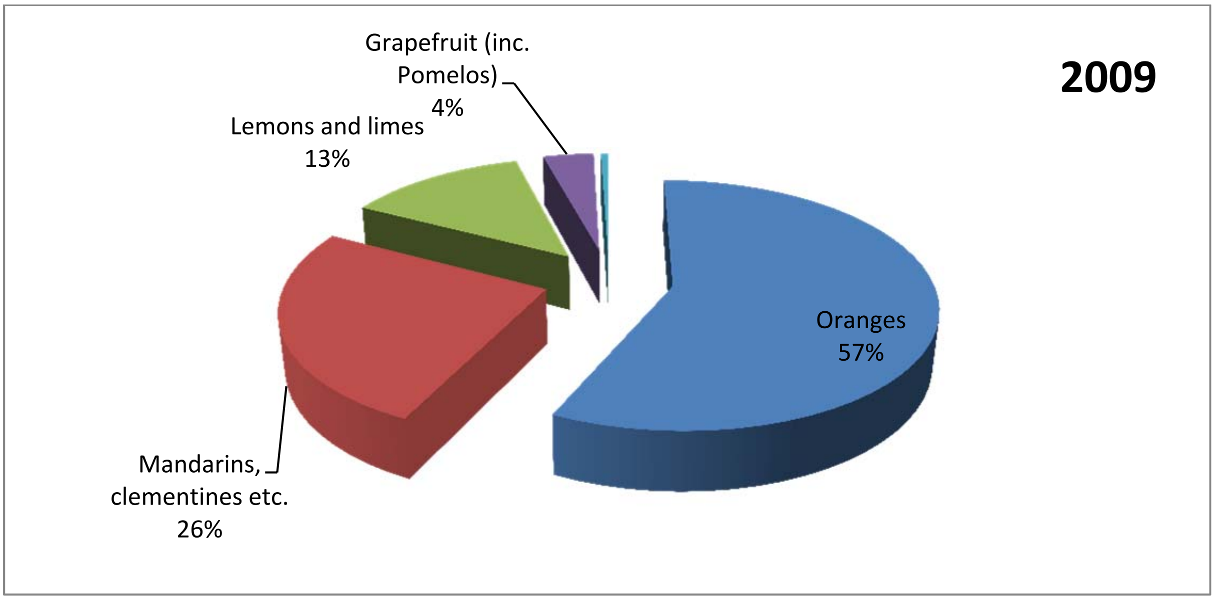
Figure 47: Trends in EU gross citrus fruit supply by product between 2002 and 2009; Unit: M.T.



Source: Own figure based on (Eurostat, 2011)

In 2009 oranges were the main citrus fruit product regarding gross supply share within the EU countries by 57%. The share of mandarins' group products was 26%, while lemons' and grapefruits' gross supply share were 13% and 4% respectively.

Figure 48: UE citrus fruit gross supply by product in 2009; Unit: %



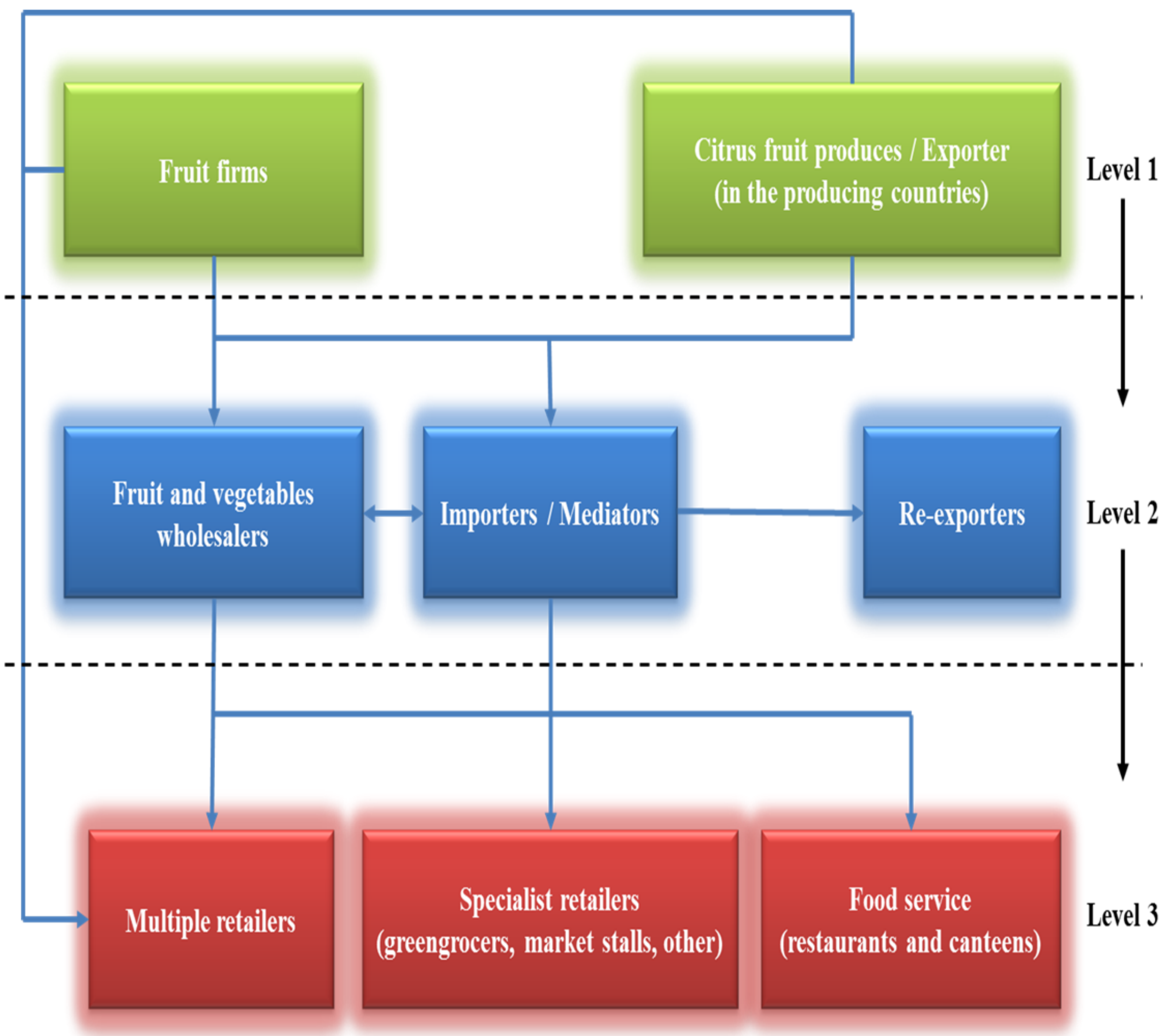
Source: Own figure based on (Eurostat, 2011)

5.3 Supply chain of fresh citrus fruit in the EU market

According to the market surveys which were performed by the Centre for the Promotion of Imports from developing countries, (CBI) in 2006 and 2009 it was possible to divide the marketing channels of fresh citrus fruit in the EU into three separate levels; (Figure 49):

1. Production level.
2. Import/wholesale level.
3. Retail level.

Figure 49: The supply chain map of fresh citrus fruit in EU



Source: Elaborated from (CBI, 2006; CBI, 2009)

The distribution system for fresh citrus fruit is well-developed in all EU member countries, especially within countries characterized by large markets for fruit and vegetables and high efficiency like in Germany and the Netherlands. Most markets are served by citrus fruit importers based in the Netherlands and Belgium. Citrus fruit are transported by sea, and Rotterdam (the Netherlands) and Antwerp (Belgium) are the main harbors (Vermeulen *et al*., 2006). Le Havre is an important international harbor in France, and Marseille for fresh produce from Mediterranean countries (such as Israel in case of importing grapefruits). Citrus fruit are imported into the EU mostly by independent importers. Some of these importers are specialized in exotic or citrus fruits while others import a large variety of fruits. It is very important for citrus fruits exporters to be advised to look for an importer which supplies supermarkets, wholesalers, greengrocers or the catering industry, and who deals in smaller quantities and is interested in new suppliers in the EU fruits markets. There are many importers of citrus fruits in the EU. For instance in Germany, an estimated 82 companies are active in the import and distribution[265].

Supermarkets are the main outlet for many citrus fruits in Germany, also discount supermarkets are important outlets. Greengrocers and street markets still have a fair share of exotic and specialist fruit sales including citrus fruit. Another market opportunity is the restaurant and catering channel (CBI, 2006; CBI, 2009).

5.4 Agricultural policies related to citrus fruit in the EU and world

Since the EU is the major importer of citrus fruit products in the world, the Common Market Organization (CMO) for fruit and vegetables of the EU Common Agricultural Policy (CAP) is one of the most relevant policy measures. Domestic support policies of CAP for citrus sector work through a system of export refunds, product withdrawal from the market based on specific intervention thresholds, and direct producer aid (Moussis, 2011).

Before the CMO for fruit and vegetables was reformed in 1996, a large part of the European budget for fresh fruit and vegetables was allocated to intervention measures (300 million €) and to export refunds (200 million €). The reform partially shifted the policy from market intervention measures to supporting producers through producer organizations and their recognized operational programs. In addition, this reform introduced minimum entry prices and took into account the Uruguay Round agreement which decreased the intervention support to around 100 € million and the export refunds to 80 € million (FAO, 1998; NAPC, 2009; NAPC, 2010).

[265] German Citrus Fruit Suppliers, Buyers & Manufacturers, available at: http://germany.tradeford.com/citrus-fruit.

According to the United Nations Conference for Trade Agricultural Development, the EU provided 204 million US$ of support to Clementine producers (Aggregate Measure of Support, AMS). An additional 71 million US$ were directed to mandarin producers and another 14 million US$ were allocated to producers of the Satsuma variety. For set aside land, orange producers received approximately 478 million US$ (FAO, 1998; NAPC, 2009; NAPC, 2010).

EU agricultural policies also include promotional measures seeking to enhance citrus production. Promotional measures for apples and citrus entered into force on 1 January 2001. The total cost of the promotional measures amounted to 8.32 million € (FAO, 1998; NAPC, 2009; NAPC, 2010).

Apart from the European CAP, world agricultural policies also include Sanitary and Phytosanitary (SPS) measures which entered into force with the establishment of the World Trade Organization on 1 January 1995. As a consequence of the existence of such policies, Clementine from Spain was banned from the United States in 2001 after Mediterranean fruit fly larvae were found in several shipments (Freshfel, 2004).

Finally, it is worth mentioning that world agricultural policies related to citrus include trade agreements amongst several countries to benefit from preferential treatment through the reduction of the level of tariffs or even the allowance of duty–free access. The most relevant example in this context is the Euro–Mediterranean association agreement. The SEAA as mentioned previously maintained the Syrian share of citrus exports to EU by 45,000 tons with annual increases of 3% and unlimited quantity for grapefruits. However, the implementation of such agreement for Syria will be difficult in the short run because of the high EU quality standard requirements and also because of the stiff competition in the citrus world market (Alvarez-Coque, 2001).

5.5 Marketing and commercial quality control of citrus fruit

With respect to the marketing and commercial quality control of citrus fruit, the Working Party on Agricultural Quality Standards of the United Nations Economic Commission for Europe (UNECE) is responsible of developing the commercial quality standards in order to facilitate international trade, encourage high-quality production, improve profitability and protect consumer interests. These standards are used by governments, producers, traders, importers and exporters, and other international organizations. They cover a wide range of agricultural products, including fresh fruit and vegetables, dry and dried produce, seed potatoes, meat, cut flowers, eggs and egg products. Regarding citrus fruit, these standards are applied to the following cultivars which classified to be supplied fresh to the consumer[266] (UNECE, 2010):

1. Lemons grown from the species *Citrus limon* (L.) Burm. F.
2. Persian limes grown from the species *Citrus latifolia* (Yu. Tanaka) Tanaka, a large-fruited acid lime known also as Bearss or Tahiti and hybrids thereof.
3. Mexican limes grown from the species Citrus *aurantiifolia* (Christm.) Swingle, also known as key limes and sour limes and hybrids thereof.
4. Indian sweet limes, Palestine sweet limes grown from the species *Citrus limettioides* Tanaka
5. Mandarins (*Citrus 169aradise169169 Blanco*), including satsumas (*Citrus unshiu* Marcow.),
6. Clementine (*Citrus 169aradise169169* hort. Ex Tanaka), common mandarins (*Citrus deliciosa* Ten.) and tangerines (Citrus 169aradise169 Tanaka) grown from these species and hybrids thereof.
7. Oranges grown from the species *Citrus sinensis* (L.) Osbeck
8. Grapefruit grown from the species *Citrus 169aradise* Macfad. And hybrids thereof
9. Pummelos or Shaddock grown from the species *Citrus maxima* (Burm.) Merr. And hybrids thereof.

These standards aim to define the quality requirements for citrus fruit at the export-control stage after preparation and packaging. However, if applied at stages following export, products may show in relation to the requirements of the standard a slight lack of freshness and turgidity and a slight deterioration due to their development and their tendency to perish in case of products which are graded in classes other than the "Extra" Class.

The holder/seller of products may not display such products or offer them for sale, or deliver or market them in any manner other than in conformity with this standard. The holder/seller shall be responsible for observing such conformity.

UNECE divides citrus fruit standards into:

1. Minimum requirements.
2. Maturity requirements.

[266] Citrus fruit for industrial processing are being excluded.

3. Classification.

More information about marketing and quality standards are available at http://www.unece.org/fileadmin/DAM/trade/agr/standard/fresh/FFVStd/English/14Citrus_2010e.pdf. Also appendix 40 summarizes marketing standards for the different varieties of citrus fruits.

6. Empirical analysis of citrus fruit supply chain in Germany

6.1 Introduction

The EU market is rather saturated and presents stability over the last years in the term of consumption. The trends of European consumption are currently characterized by increasing interest for more health food, organic food and exotic fruit and vegetables. At the same time consumers are highly concerned on food safety, quality and environmental protection, but convenience is of outmost importance as well (Abbenhuijs, 2004)

Total EU consumption of fresh citrus fruit amounted to 12.11 million tons in 2009. Most important consumer markets for citrus fruit are Italy, Spain, and Germany which account together for about 61% of total EU citrus fruit consumption[267].

Since this research aims at improving marketing opportunities for Syrian citrus fruits in EU countries, especially in Germany[268], a supply chain perspective was applied and questionnaire-based survey of wholesalers and retailers for fruit and vegetable in different German cities conducted in order to collect and evaluate detailed information on the citrus fruit supply chain. The findings may help to improve the efficiency of the chain by identifying chances for a greater Syrian-European cooperation as well as possible restrictions and difficulties. A thorough knowledge of major German consumer and marketing trends is crucial in order to provide strategic support for Syrian producers and exporters, and will probably lead to enhanced market opportunities for the Syrian citrus fruits. Also it is an important step in the right direction, which points to the progressive opening of the EU markets.

This empirical analysis is an effort to define the citrus fruits' wholesalers and retailers as very essential partners along the supply chain and to encourage collaboration along the chain with the aim of improving product quality, market access, and efficiency of supply in the German citrus fruit market. In addition to increase the industry's efficiency in delivering citrus from origin to plate by identifying opportunities for collaboration along the chain and, where possible, address barriers/limitations in the supply chain.

[267] See section (5.2.3).

[268] The survey was done in Germany, as it is the biggest net-importing country of citrus fruit within the EU.

6.2 Study design and data collection

For the purpose of this study which aims to conclude and summarize the main trends of the German citrus fruit supply chain and issues of importance for citrus fruit exporters from Syria, 250 questionnaires were distributed. However, only 65 wholesalers and retailers of fruit and vegetable in different German cities answered as shown in Table 54.

Data were collected between August and November 2011. The stores were found in the supplier list of fruit and vegetable markets in Germany. Although they are not representative for all wholesalers and retailers of fruit and vegetable in the German market, they provide an initial perception of this market in different German regions.

Research was undertaken by face-to-face surveys. Face-to-face interviews generally took between thirty minutes and one hour. In terms of these interviews, every effort was made in each market to identify and consult with those stores dealing in citrus fruit. Some of these questionnaires were filled directly during the presence of researcher; the rest were sent back per post after filling by the wholesalers and retailers. The research findings were then analyzed and interpreted by using SPSS and Excel programs.

The following table summarizes the consultation undertaken during the study.

Table 54: Number of consulted stores and their location

Location		Category			Sum in the federal states
Federal State	**City**	**Retailers**	**Wholesalers**	**Sum**	
Berlin	Berlin	20	4	**24**	**24**
Hamburg	Hamburg	1	1	**2**	**2**
Niedersachsen	Hannover	7	2	**9**	**16**
	Göttingen	5	0	**5**	
	Braunschweig	2	0	**2**	
Hessen	Gießen	1	0	**1**	**11**
	Frankfurt	4	0	**4**	
	Marburg	4	0	**4**	
	Kassel	1	1	**2**	
Sachsen	Dresden	1	0	**1**	**1**
Baden-Württemberg	Stuttgart	0	1	**1**	**2**
	Ditzingen	0	1	**1**	
Bayern	Eggstätt	1	0	**1**	**9**
	Nürnberg	4	4	**8**	
Sum		51	14	**65**	**65**
%		**84.6%**	**15.4%**	**100%**	**100%**
Female in %				**15%**	
Male in %				**85%**	

Source: Own table

The developed survey consists of thirty questions divided into:

1. General data about the surveyed traders including personal information, store location and size, number of customers, turnover, and store labors.
2. Information about products, origin, marketing criteria, and terms of agreement.
3. A third part specifically dealing with citrus fruits from Syria.

The survey included three open questions. In most cases a scale from (-2 to +2) was used.

Table 54 shows that the surveyed traders were 14 wholesalers and 51 retailers. 15% of them were female and 85% were male.

The average age of traders was about 46 years; age ranged between 23 and 68 years. Other operational indicators related to the retailers' and wholesalers' stores are presented in Table 55.

Table 55: Operational indicators of the fruits and vegetables stores

	Average	Minimum	Maximum
Size of salerooms in m²	382.6	(0)[1]	8900
Employees number	26	1	1100
Daily basis customers	309	40	3500
Regular customers in % of basis	70.8%	20%	100%
Age of surveyed traders (years old)	46	23	68
Year since the store exists	1979	1860	2010
The annual turnover in € for retailers	90,000	10,000	>100,000
The annual turnover in € for wholesalers	>1,000,000	375,000	>1,000,000

[1] One of the surveyed wholesalers referred that he is managing his business from his house. So he has no wholesale store.
Source: Own table

6.3 Survey findings

This section of the study details the findings of the research undertaken with fruit and vegetable wholesalers and retailers in the German cities mentioned in Table 54. The survey results follow the format of the questionnaire (Appendix 41).

Based on FAOSTAT database in 2010, the countries of citrus fruit origin which are included in the questionnaire have been chosen according to their import quantities of citrus fruit to the German market. These countries are Spain, Italy, South Africa, Israel, Morocco, China, and Turkey. Syria was included as the main country of interest in this study. This sample of origin countries includes the largest exporter for citrus fruit in the EU, Spain and Italy, and three important exporters from Mediterranean countries (Turkey, Morocco, and Israel). China and

South Africa have been chosen as main export countries of citrus fruit from outside the EU to Germany.

6.3.1 Citrus fruits in terms of products, origin, marketing criteria, and contracts

Table 56 shows that the sales of citrus fruit in the German surveyed stores constituted about 10% in average of the total fruit, vegetable and other commodity sales in these stores. The minimum proportion was 1% and the maximum proportion was 40%. The standard deviation was 9.21%.

Table 56: Proportion of major fruits and vegetables groups' sales; Unit: in % of total store sales

	Average	Minimum	Maximum	Median	Standard Deviation
Vegetable	29.56	0	60	30	15.29
Citrus fruit	9.7	1	40	5	9.21
Other fruits	23.16	3	50	21.5	12.15
Others	37.34	0	90	40	27.15

Source: Own table

In accordance with personal interviews through the distribution of questionnaires, it was found that only three retailers deal with organic products. However, the proportion of organic citrus fruit was about 21.41% in average of the total sales of organic commodities. Some retailers mentioned that they did not deal with organic products including citrus fruit as a result of their high prices within market, which reflected negatively on the willingness of their customers to buy such commodities[269] (Table 57).

Table 57: Proportion of organic products; Unit: in % of total store commodity

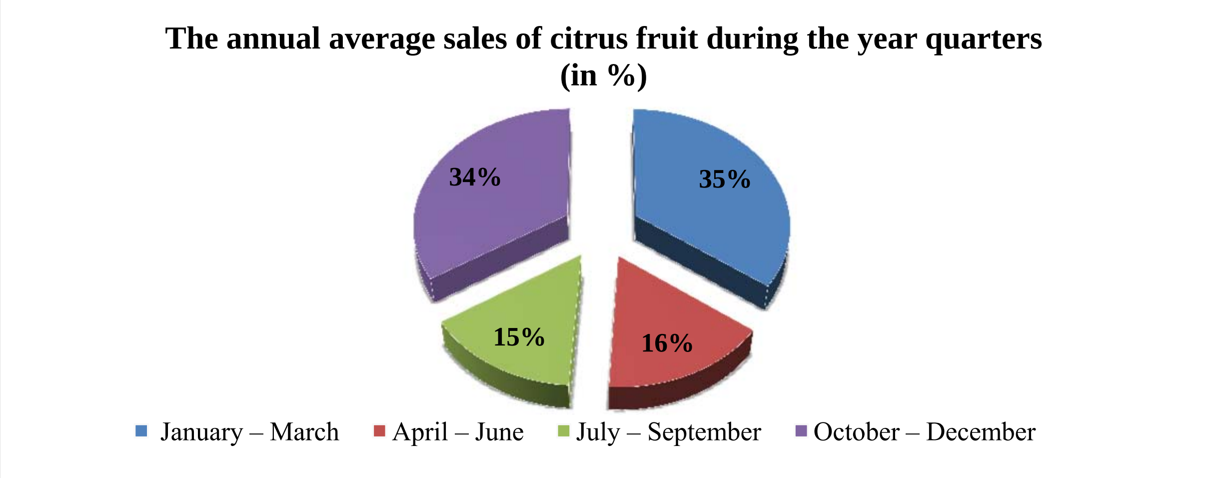
	Average	Minimum	Maximum	Median	Standard Deviation
Vegetable	22.37	0	100	5	34.69
Citrus fruit	21.41	0	100	3	34.86
Other fruits	20.45	0	100	5	33.32
Others	15.7	0	100	0	33.55

Source: Own table

[269] These surveyed retailers said that their consumers buy organic citrus fruit when the have a discount on their prices.

According to the survey results, about on average 69% of annual sales of citrus fruit are concentrated during the period between early October and late March. On the other hand, about 31% in average of annual average sales of citrus fruit are sold during the other six months.

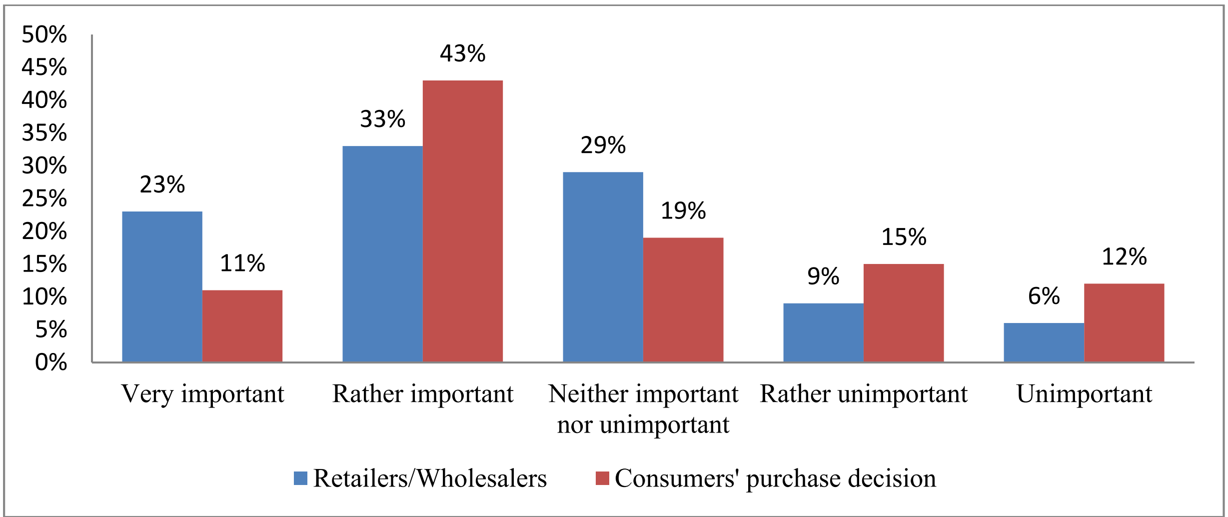
Figure 50: The annual sales of citrus fruit during the year quarters; Unit: in %



Source: Own figure

Figure 51 indicates that the influence of citrus fruit origin country on the purchase decision of 43% of the German retailers' and wholesalers' customers[270] is rather important. This aspect is very important to 11% of them. On the other hand, the country of origin is very important to 23% of surveyed retailers and wholesalers and rather important to 33% of them.

Figure 51: The importance of citrus fruit origin for traders and consumers; Unit: in %

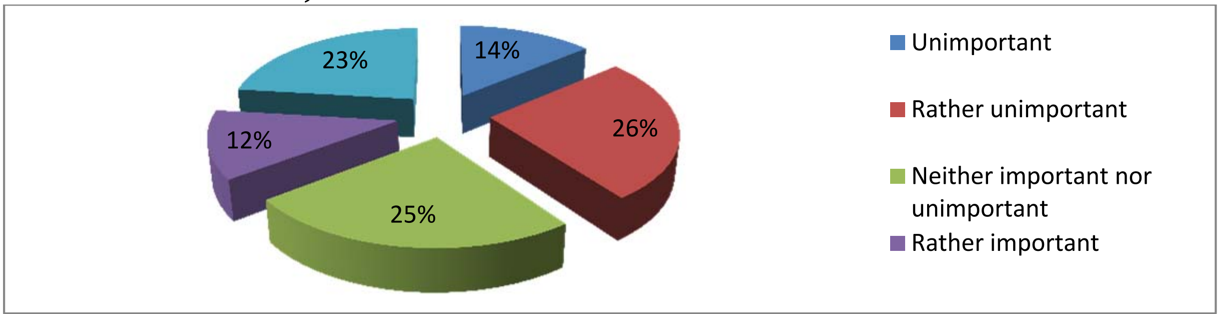


Source: Own figure

[270] The proportion which is referred in this question reflects the opinion of the citrus consumers from the perspective of the retailers and wholesalers.

Figure 52 shows that 23% of the surveyed traders say that the organic citrus fruit is very important for their customers' purchase decision. 25% say that the organic citrus fruit is neither important nor unimportant, 26% say it is rather unimportant, and 14% find it unimportant to the purchase decision of their customers. These results emphasize the survey findings in table 57.

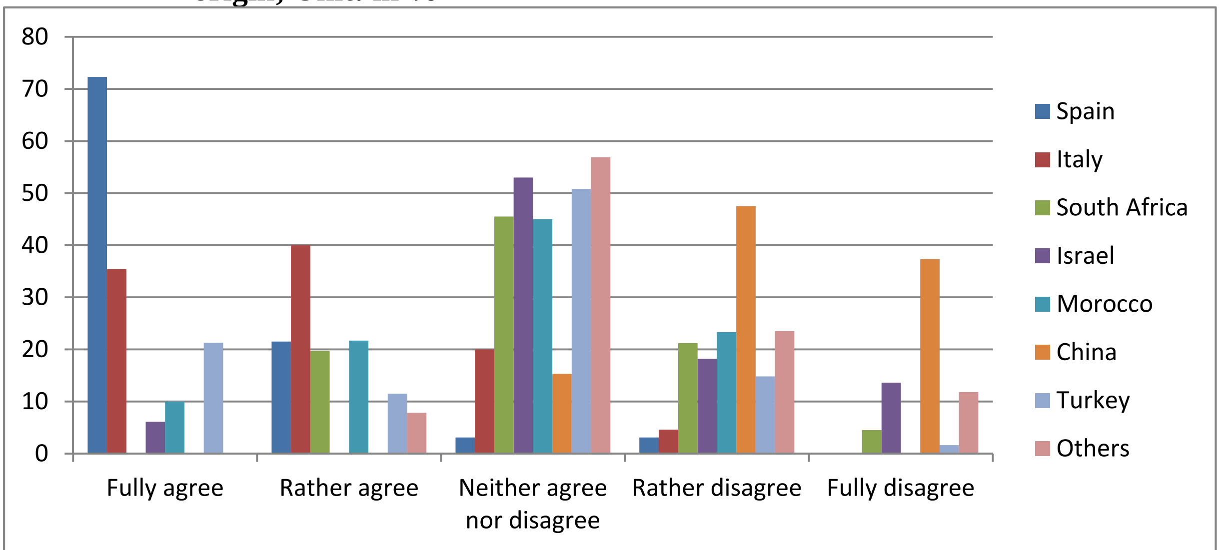
Figure 52: The importance of organic citrus fruit on the consumer's purchase decision; Unit: in %



Source: Own figure

Figure 53 illustrates that more than 70% of the surveyed citrus dealers are fully agree with Spain as a preferred resource of citrus fruit products. Italy comes in the second place. Israel, Turkey, South Africa, Morocco, and some other countries like France[271] are preferred moderately. However, more than 40% of surveyed dealers are rather disagree with China as a preferred country of origin of citrus fruit due to the long distance between Germany and China, which increases the cost of transport.

Figure 53: The preferences of retailer/wholesaler toward countries of citrus fruit origin; Unit: in %

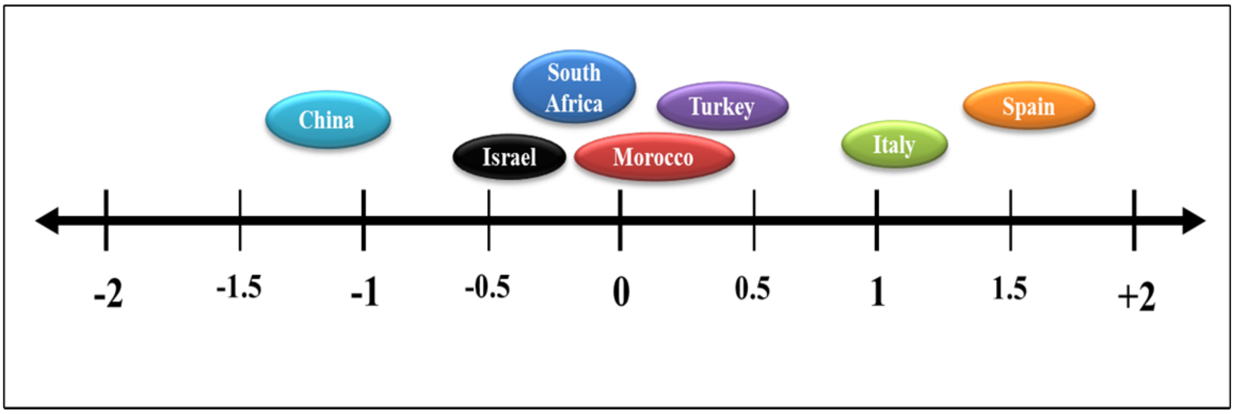


Source: Own figure

[271] Limes from France are very preferred in the German market.

The previous findings are shown in figure 54 by using a scale of preferences ranges between +2 (fully agree) to -2 (fully disagree). Spain and Italy have the highest evaluation by 1.6 and 1.1 respectively where Turkey and Morocco have neutral preferences by 0.7 and 0.2 respectively. China is rejected by an evaluation of -1.2.

Figure 54: The preferences scale of the citrus fruit origins' countries



Source: Own figure elaborated from (Kennerknecht *et al*., 2007)

Table 58: The last year and expected shares of citrus fruit sales; Unit: in %

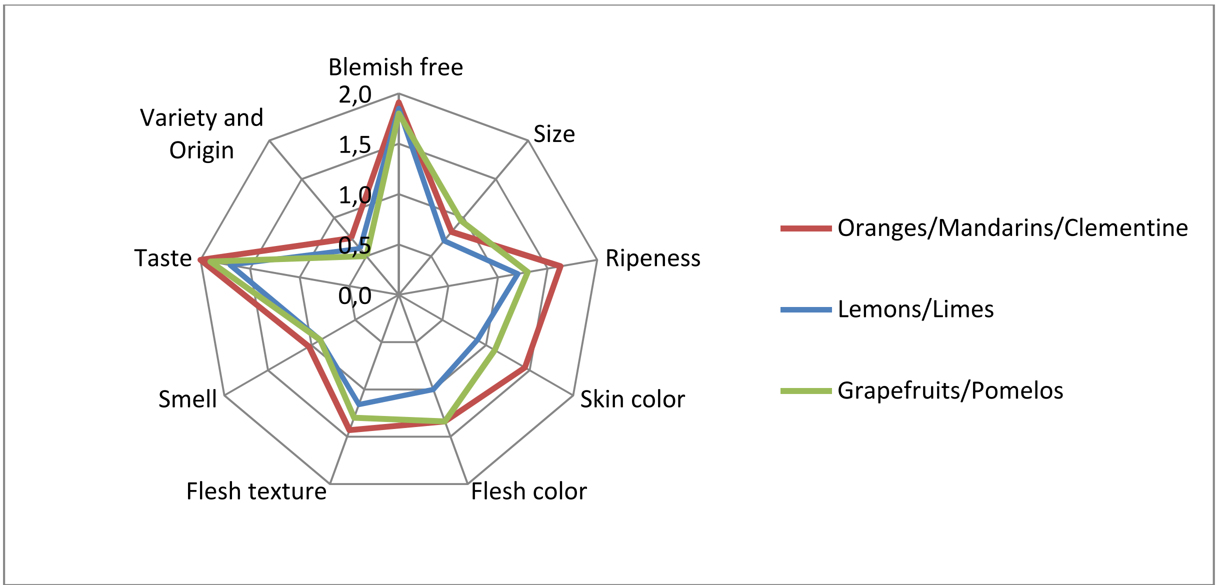
	The shares of sold citrus fruit during the last year			Expected shares of citrus fruit sells during the next five years		
	Oranges/ Mandarins/ Clementine	Lemon /Lime	Grapefriut/ Pomelo	Oranges/ Mandarins/ Clementine	Lemon /Lime	Grapefruit/ Pomelo
Spain	53	45	16	51	42	12
Italy	19	30	9	19	31	9
South Africa	5	4	7	5	3	7
Israel	4	3	19	5	3	20
Morocco	9	2	1	10	3	1
China	1	0	8	0	1	10
Turkey	7	8	13	7	8	13
Other	2	8	27	3	9	28
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Source: Own table

Table 58 shows that Spain and Italy are the most important resources of oranges, mandarins, and lemons. More than 70% of these products are imported from Spain and Italy. The proportion of these products will remain steady during the next five years. Table 58 also shows that Israel is the main resource of grapefruits and pomelos among the studied countries. However, there is diversity regarding the resources of grapefruits and pomelos. Generally, the results of this table agree with the results which are introduced in figure 53 and figure 54.

The answer of question 19: “Please evaluate the following marketing criteria on a scale from 1 (unimportant) to 5 (very important) for the following product groups: Oranges/mandarins/clementine, lemons/limes, and grapefruits/pomelos” is clarified in the figure 55 by using a net diagram.

Figure 55: Evaluation of quality criteria by product

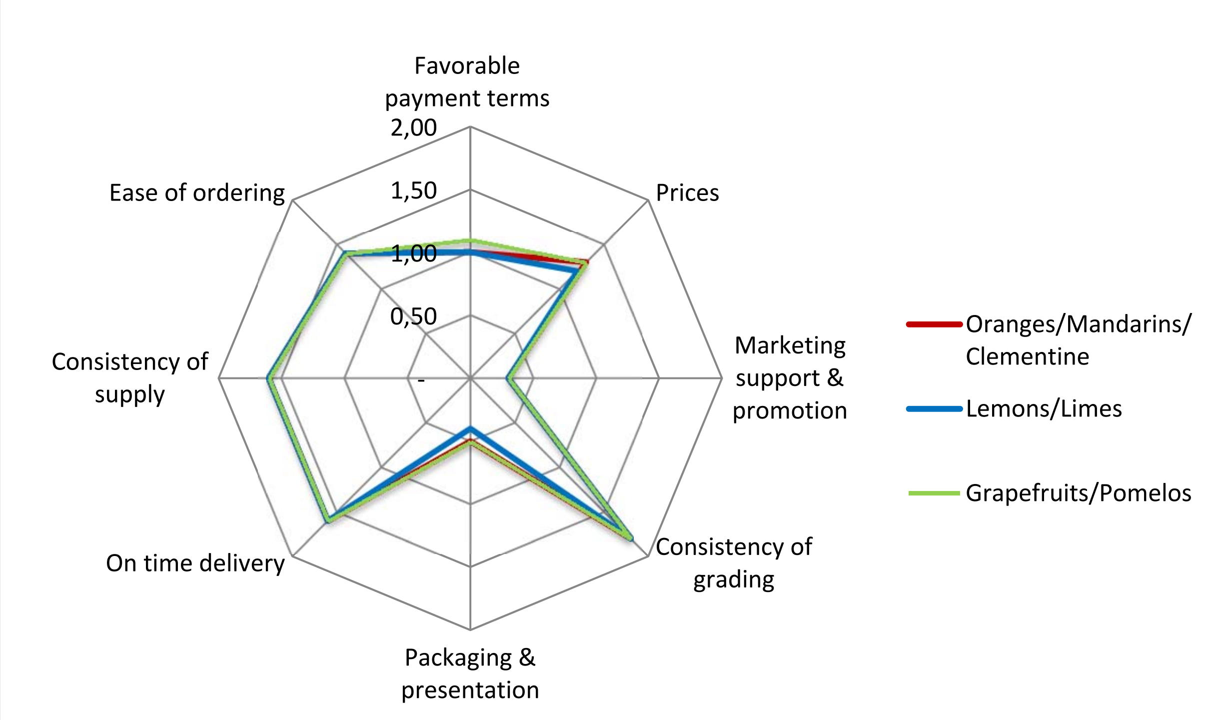


Source: Own figure

99% of the surveyed retailers and wholesalers answered that taste and blemish free fruits are the most important quality criteria for them. Then the ripeness of fruit, skin color, and flesh texture come into the second place for oranges group. For lemons group and grapefruits group, flesh texture and ripeness come in the second place. The size and smell of fruits have the lowest importance.

The answer of question 20: “Please evaluate the following terms of contract on a scale from 1 (unimportant) to 5 (very important) for the following product groups: Oranges/mandarins/clementine, lemons/limes, and grapefruits/pomelos.” Is illustrated in the figure 56.

Figure 56: Evaluation of contract terms by product



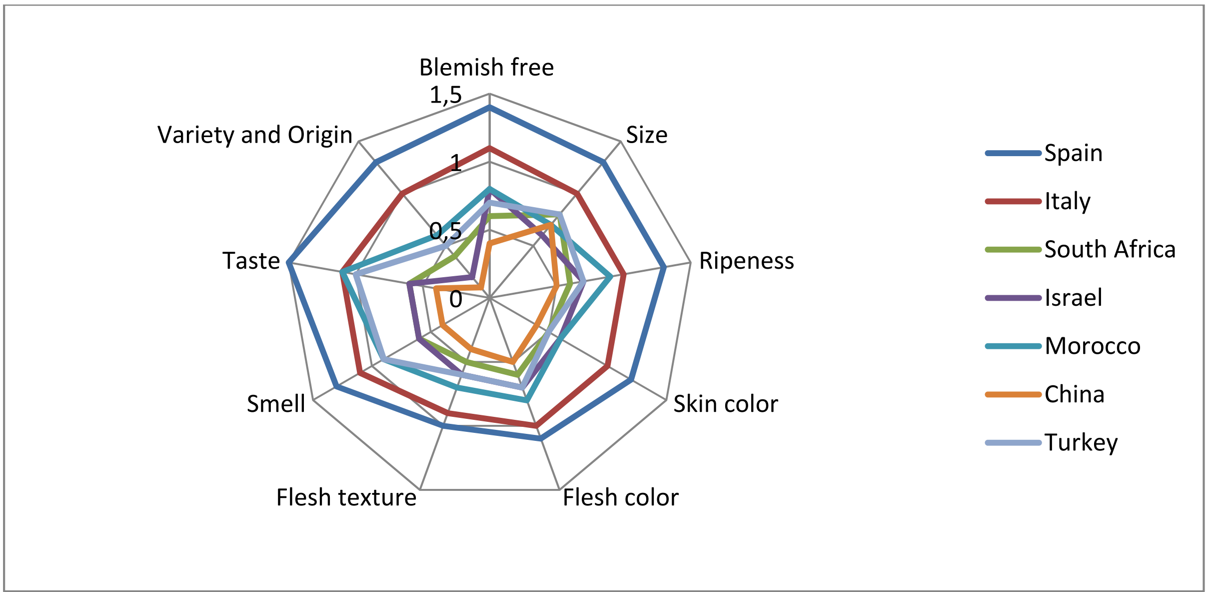
Source: Own figure

Almost all surveyed traders answered this question and evaluated the importance of the eight specified terms. The consistency of grading is the most important term for the three groups of products. The importance of supply consistency and on time delivery come second, while prices and ease of ordering come into the third place of traders' importance. The packaging and presentation in addition to marketing support and promotion have the lowest importance for traders. That is because they are responsible of repacking and promoting their commodities as their customers prefer.

The answer of question 21: "Please tell us how content you are with the following quality criteria on scale from 1 (very discontent) to 5 (very content) regarding the country of origin" is shown in the figure 56.

The number of traders who answered this question ranged between 33 and 65, as some of the retailers mentioned that these quality criteria have no role as a preference because they are selling the citrus fruits which are available in the market. However, most surveyed traders give highest degree of content to the taste of citrus fruit which imported from Spain. Taste of citrus fruits imported from Morocco shared the second place with Italy. Traders show lowest degree of content concerning quality criteria of the citrus fruit imported from China. In general, the results of this question emphasized the findings of question 17 which were illustrated in figure 53 and figure 54.

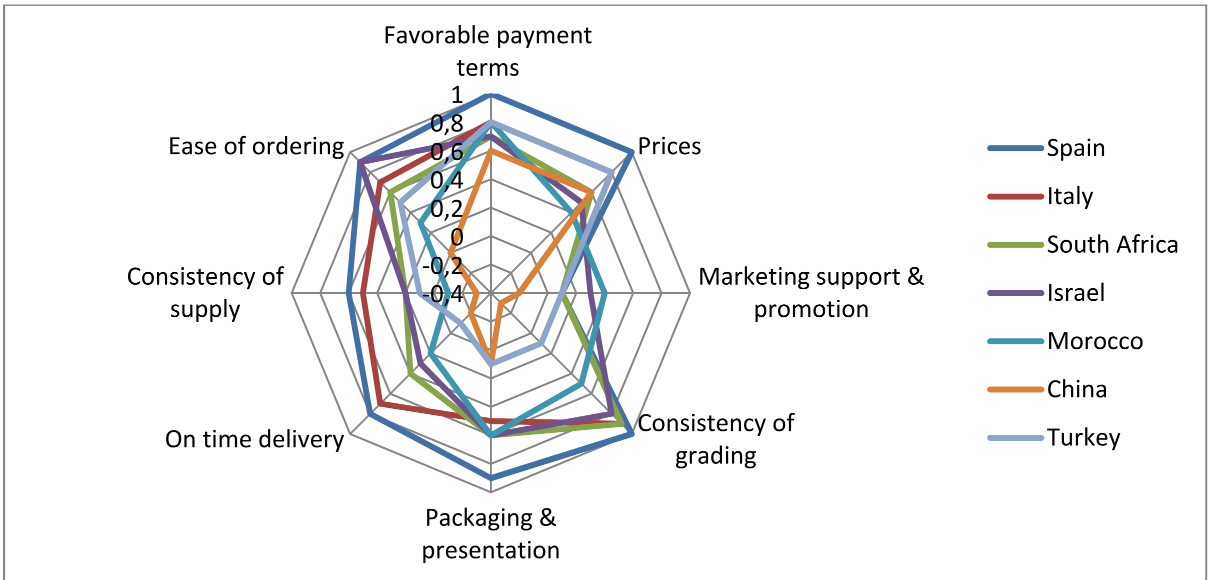
Figure 57: Evaluation of quality criteria by country of origin



Source: Own figure

The answer of question 22: “Please tell us how content you are with the following terms of contract on a scale from 1 (unimportant) to 5 (very important) regarding the country of origin” is presented in figure 58.

Figure 58: Evaluation of contract terms by country of origin



Source: Own figure

The majority of surveyed retailers did not answer this question because they are not dealing with the various countries and they do not have any contact to the importers. Conversely, the surveyed wholesalers rather agree with the importance of prices, favorable payment terms, and consistency of grading as contract terms of citrus imported from Spain. The consistency of supply and on time delivery in addition to marketing support and promotion for the contracts with China and Turkey, have the lowest importance.

6.3.2 Syrian citrus fruit from the perspective of German fruit and vegetable dealers

This section gives an initial view of the ability of Syrian citrus exporter to compete with exporters from other countries.

Questionnaires' findings show that 99% of surveyed dealers did not know Syrian citrus fruits and have not dealt with it because there have been no imports of them toward Germany. Only one wholesaler in Berlin referred that he sold a small quantity of Syrian oranges through his store in 2007. This quantity was a test sample. He was satisfied with the quality of the product, but at the same time he pointed out that the transport cost was high in comparison with the costs of transport from other Mediterranean countries. He also mentioned that he does not deal with products coming from China or South Africa.

Table 59 shows that 58% and 50% of the surveyed traders fully agree with the expectation of good prices and very high quality respectively for the Syrian citrus fruit. Just 2% rather disagree with the aspect of very high quality. Generally, 40-50% of the surveyed dealers fully agree with the other expected aspects. On the other hand, just 7% of the sample fully disagrees with the aspect of marketing support as an expectation from the Syrian side.

Table 59: The wholesalers' and retailers' expectation from Syrian citrus fruits; Unit: in % of the total sample

	Fully agree	Rather agree	Neither agree nor disagree	Rather disagree	Fully disagree
Very high quality	50	31	17	2	0
Dependable business partners	48	30	14	8	0
Good price-performance ratio	58	28	14	0	0
Large variety of tastes	43	38	13	6	0
Favourable payment terms	40	28	24	8	0
Marketing support	39	19	24	11	7
Timely delivery	49	25	18	8	0
Dependable supply	51	21	16	12	0

Source: Own table

Within questions numbers 25, 26, and 27, three features were identified as results of the study of the Syrian citrus fruit production in the previous sections of this research. These features are:

1. Syrian Citrus fruits are free of the impact of residual pesticides, because of applying integrated biological control programs (95% of Syrian citrus fruits are considered as organic products with a very high quality).
2. There are multiple varieties and strains of citrus fruit in Syria, which have the advantage of medium-late and early maturity, about a month earlier than European countries, and are distributed throughout the year.
3. The producing costs of Syrian citrus fruits are very low and that, thus, its prices are cheaper than prices in the EU region, at least at the farm level.

Table 60: The response of surveyed traders towards the statements of questions 25, 26, and 27; Unit: in %

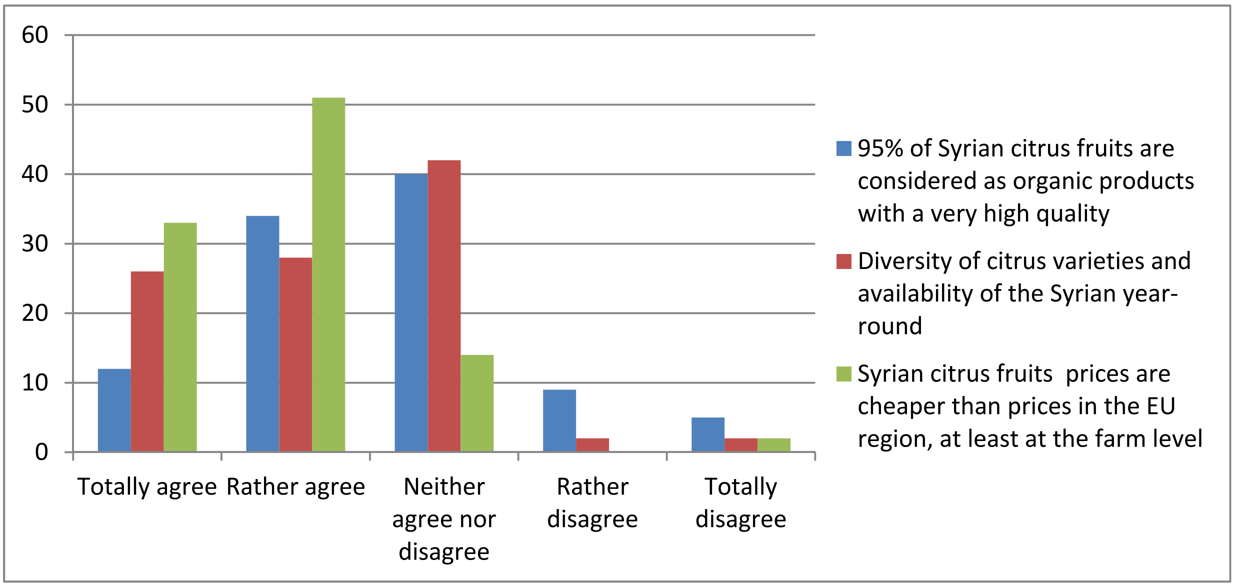
	Totally agree	Rather agree	neutral	Rather disagree	Totally disagree
Syrian citrus fruits are free of the impact of residual pesticides, because of applying the integrated biological control programs (95% of Syrian citrus fruits are considered as organic products with a very high quality	12	34	40	9	5
there are multiple varieties and strains of citrus fruit in Syria, which have the advantage of medium-late and early maturity, about a month earlier than EU countries, and distributed throughout the year	26	28	43	2	2
the producing costs of Syrian citrus fruits are very low and that thus its prices are cheaper than prices in the EU region, at least at the farm level	33	51	14	-	2

Source: Own table

The results of questionnaire showed that 99%, 97%, and 95%, respectively, of the surveyed dealers did not know any information about these features. However, more than 50% rather agree with the contribution of low citrus prices in giving Syrian exporters the opportunity to compete in the German fruit market. 33% totally agree with this aspect. This result reflects the importance of prices for the competitiveness in the German market with respect to citrus fruit products. Concerning the other two features, about 40% of the surveyed dealers moderately agree with. These results reflect a moderate importance for these statements in the citrus fruit market (Table 60).

Figure 59 presents the previous results.

Figure 59: The response of surveyed traders towards the statements of questions 25, 26, and 27; Unit: in %



Source: Own figure

Table 61 presents the respond of surveyed German fruit dealers to the availability of Syrian citrus fruit products in the German market with respect to the following statements:

7. 30% totally agree with selling Syrian citrus products in their stores, 28% rather agree, and 31% moderately agree. Conversely, just one trader totally disagrees with this statement.
8. 25% totally agree with the un-need of the German market to import Syrian citrus products as there are sufficient quantities of these products from other partner countries. However, 24% and 13% of the surveyed dealers, respectively, rather disagree or totally disagree with this statement.
9. 32%, 18%, and 41% totally agree, rather agree, and moderately agree, respectively with the willingness of German consumers to buy and test new citrus varieties from new countries.

These results show that the Syrian citrus fruit products have the opportunity to compete within German market.

Table 61: The behavior of surveyed German traders in case of availability of Syrian citrus fruit in the German market regarding the statements below; Unit: in %

	Totally agree	Rather agree	neutral	Rather disagree	Totally disagree
I will sell Syrian citrus fruit in my shop.	30	28	31	10	1
The German market has enough quantities of citrus fruit from different countries and there is no need to import citrus fruit from Syria.	25	11	27	24	13
German Consumers like to experience new varieties from new origins!	32	18	41	7	2

Source: Own table

With respect to the question 29, most of the surveyed traders have referred that Syrian citrus fruit may have chance to compete other countries of citrus fruit origin in the German market if Syrian exporters comply the applied marketing standards which related to quality and health food. Few of the surveyed traders have said that Syrian citrus fruits' exporters have no chance to compete into the German market because of the because of the difficult conditions imposed by the European Union on the imported products as well as the protectionism applied within the European Union markets.

7. Conclusions and perspectives

Syrian agriculture faces new opportunities in a liberalized trading world. The European Union has been one of the most important new markets for the Syrian citrus output but trading among the neighbors has to expand in the future, specially, with the countries of (GAFTA) region and eastern Europa.

This research identifies the export opportunities for Syrian citrus growers to the EU from the perspective of supply chain and answers the question of how the Syrian citrus sector to become more competitive and gain market share in the EU countries as the low cost of citrus production in Syria nowadays is not a strong reason although it helps. It also considers that the competition in the EU markets is the most determinant obstacle for the development of Syrian citrus exports through applying protectionist policies.

The main findings of this research was based on a detailed study for the comparative advantages of Syrian citrus sector in addition to a general analysis for citrus supply chain in Syrian and European markets.

The issue of citrus fruit surplus in Syria

Citrus fruits can only be stored for short periods without marked deterioration because it is a perishable crop. The results of this study show that there is a national citrus surplus during recent years, within Syria, of several hundred thousand tons. Consequently, stocks cannot be carried over from one crop year to the next. In order to prevent a part of the crop being spoilt it is very important that all that is produced during a crop year be sold in that year. This, in turn, will not be possible unless the prices in the domestic market are sufficient to cover farmers' harvesting and marketing costs.

On the other hand, 90% of the citrus production is produced in the small and medium-sized farms[272] that normally grow more than one type of citrus and often several varieties of each type. The main types of citrus and the varieties of each tend to be harvested at different times of the year. Coupled with a need for a regular flow of income, these characteristics of Syrian citrus production denote that most farmers market very small amounts of citrus frequently throughout much of the year. In the case of lemons, the crop is harvested and marketed over most of the year. Therefore, it is necessary either to create marketing cooperatives or to establish a class of small traders in order to assemble the product, but this has not happened in

[272] See 2.3.6

Syria. Consequently, most growers are forced to transport their citrus to urban wholesale markets themselves. This situation leads to a number of damages:

1. Most Syrian growers lose an extreme amount of their time marketing their crop and investigating market conditions in an attempt to ensure that he delivered his crop to the most revenue market. This causes them to be away from their groves instead of taking care of labor and management which has the priority during this period.
2. They have to pay more costs because the small quantities marketed show that citrus is normally transported in small trucks or pickups. This adds a relatively high unit cost to the costs of transportation especially after the raise of diesel prices in Syria during the last years.
3. The identification of citrus selling prices depends on personal negotiation; this gives a little market power to the most citrus growers.
4. The process of grading and preparation of the citrus product must take place on every farm rather than at specialized facilities; which increases the costs of production in addition to decline the quality of the marketed citrus fruits.

The issue of competitiveness

Study of the comparative advantage and the supply chain analysis for Syrian citrus fruit suggest and manage the following issues which are necessary to improve the competitiveness of Syrian citrus sector:

1. Recently, a major global development has occurred in production and trade of citrus fruit. Therefore, Syrian citrus sector need to adapt faster to this market trends in size of production, and in new varieties.
2. Syria has comparative advantage in producing fresh citrus fruit in addition to low labor costs. However, this cannot be considered as the only factors of success in the international marketing. Due to The crucial role of world prices in attaining the Syrian citrus to the international markets and the substantial competition from other countries which produce efficiently the same product. This requires a high degree of supply chain coordination to reduce other costs, improve performance on the entire commodity chain and remove constraints.
3. In Syria, there is lack of specialized companies in exporting citrus fruit and lack of international standards related to grading, sorting, packaging and product homogenization. In addition to the lack of proper requirements for storing,

refrigerating, waxing and packaging. Which are essential to improve the economic revenue and increase the competitiveness by identifying the direction of finale product; either for export or domestic marketing or for manufacturing (Class III and IV).

4. The exportable pack out ratio[273] is generally low. This means that the exporters are forced to reduce prices offered to citrus growers as a result of absence of clear grading and quality standards. Also, this will reduce the capacity of the exporters to be profitable and competitive in the foreign markets.
5. Importers and consumers in the EU countries are increasingly more demanding in terms of citrus fruit quality and standards. Therefore, Syrian citrus sector stakeholders need to adopt major improvements in the supply chain to be able to enter these promising markets.
6. Even though the fact that the raw material prices, services, and the labor dominate the citrus value chain costs, the issue which is facing stakeholders in the citrus value chain is not necessarily to focus completely on production cost/price reduction at farm level as much as it is related to establish a supply chain that rewards quality for a market-bearing price of exportable citrus.
7. Increase the unit shipments cost as a result of the lack of large transport companies in Syria in addition to the fact that many trucks are old and the supposed destination countries in the EU are relatively far. This will lead decrease the competitiveness of Syrian citrus sector.
8. Exports to saturated markets, like in the case of the European Union, are difficult and many times not so profitable. Therefore the regional trade flows among countries of similar development levels is a more profitable aim for most enterprises. This implies that lack of fears among country neighbors is necessary, especially in raising economies where population is increasing and economic growth is important. This could be an intermediate step towards moving to more competitive markets in the most developed countries.
9. Inefficient marketing policies which affect negatively the marketing opportunities. Where the bulk of citrus quantities intended for export is purchased from the

[273] It is the ratio of citrus which meets export quality standards and the total volume of fruit purchased from growers for the export market. Through the limit investigation it was difficult to estimate this ratio because the exporter buys the whole quantity without classification.

wholesale markets. This causes additional costs which is mainly related to the brokers' commissions and the additional transportation costs

10. The competitiveness for Syrian citrus fruit exporters will be imperfect due to the shortage of studies which aims to discover new markets for Syrian citrus products and the studies that might investigate consumer preferences within promising markets, in addition to the deficiency of studies on the citrus types which may have opportunities to compete within foreign markets (like EU markets) such as Grapefruits and Clementine. On the other hand, the lack of promotional policies for Syrian citrus products within target markets plays a negative role in increasing this competitiveness.

The issues of opportunities and threats

The fresh citrus fruit market in the EU offers both opportunities and threats for exporters in Syria as a developing country. There are major opportunities in creating or adapting products that serve market segments and capitalize on trends in consumption, production and trade. The major opportunities for exporters of citrus fruit from Syria to the EU are summarized as following:

1. EU consumption of fresh citrus fruit exceeds production.
2. Increase out-of home consumption of fruit in the restaurant and foodservice channels.
3. The growing demand for health-promoting products, convenient, organic, ready-to-eat products and off-season supply of traditional products such as oranges.
4. Supplying citrus fruit during the off-season of EU production.
5. Participation in an efficient and market-driven supply chain (involves increasing the scale of production).

The major threats for exporters of citrus fruit from Syria to the EU market are summarized as following:

1. The current economic crisis will have an effect on the market for fresh fruit and vegetables, thus the consumed quantities of citrus fruit will decrease.
2. The value of consumption is more likely to decrease as consumers may choose other, lower-valued, products.
3. Certification and food safety requirements for fresh citrus fruit (GlobalGAP, formerly EurepGAP) and for processed fruit (GMP/HACCP/BRC), which involve serious managerial and technical efforts and high costs. These certification requirements are

strictly required to gain access to north-western European countries and, increasingly, in the southern and western European countries.

4. Fluctuating prices and production volumes of citrus fruit due to fluctuating supply in the EU.
5. Control of supply chains by large multinationals who demand a high level of professionalism and large-scale supply.
6. Consumer preference for domestic fresh products, particularly in their growing season.
7. Fluctuations in EU production due to variable weather conditions during the growing season, which cause either a surplus or scarcity in fruit production. These fluctuations have a strong influence on prices and on imports and exports volumes and are hard to predict.

It is obviously that the trends and market developments in the EU countries offer both opportunities and threats to Syrian exporters. A trend can be a threat to some but an opportunity to others. Therefore, they should always be analyzed in relation to specific exporting company circumstances. The exporter's specific situation determines whether a development or trend provides an opportunity or threat.

An important trend in the citrus sector is the consolidation of buying power, which forces producers to focus more on quality, cost and efficiency. Major retailers in the EU market prefer to work with a limited number of suppliers, which favors large producers who can serve them efficiently. If small-scale exporters can increase their supply by joining forces with other small-scale producers and forming grower groups or marketing cooperatives, they can benefit from this trend and work with these large buyers. In contrast, exporters who do not manage to increase their output will increasingly be excluded by importers. This will limit their export opportunities to a declining number of small-scale buyers or to niche markets. However, in the longer term, many of these niche markets may evolve into mainstream markets where similar demands will prevail.
According to these findings, the Syrian citrus fruit sector has insufficient export opportunities to enter the EU markets in the short term. Thus, a question that arises from this study is whether or not Syria is basing its export growth on a sustained basis. One might ask about the problems to be faced by Syria, as a result of the possible lack of adaptation of its production to the new market trends. On the other hand, the SEAA[274] will open market opportunities which can only be fully exploited through a significant improvement of the performance of

[274] Syrian-EU Association Agreement.

Syrian citrus products in foreign markets. Conversely, the increase of competitiveness for Syrian citrus exports to the regional markets becomes a priority in spite of the importance of the EU market in the long term.

8. Managerial, political, administrative and governmental implications

1. Major extension support should provide considerable assistance to citrus growers in Syria to improve their plant nutrition management at the farm level to produce fruit of improved quality, size consistency, and appearance, which in turn would increase exports to existing partners and to developed market.
2. Extension units should spread knowledge at the farm level about new varieties that in demand regionally and globally.
3. Regional market is the skyline in the short extend that Syria should work on to strengthening its position and extending citrus exports before moving to other markets.
4. There is a need of existing of third party controlled grading and quality standards which help in reducing the quality risks linked to citrus price that determined sometime randomly and resulting unfair price estimation for farmer when dealing with exporter.
5. You may also mention the reinforcement of exporters' capacity in having info on export market and playing a role in establishing quality management long the value chain (best practice, quality reward mechanism etc.).
6. Putting a quality control is important but not enough to upgrade the quality standard in addition to expand the biological pest control which is desired currently.
7. In light of the benefits associated with drip irrigation, increased credit support to citrus growers for adoption of such systems is anticipated to improve citrus farming operations in Syria, especially after the obligatory decision to move to drip irrigation system.
8. Exports as activity should organize in compatible way, and it is important for Syria to study the destination markets carefully to draw the future of these markets in term of quality, size, income, and lifestyle. This study will help to put new export strategies in these markets.
9. Another option is to strengthen current Syrian citrus sector position on markets where it has already a good position for intermediate quality segments (Iraq and Jordan) where consumers might be less sensitive to product packaging and appearance. The high potential growth of opening market with middle-income consumer's market segment can offer additional outlet to Syrian producers within this options. If this option is followed competitiveness should be strengthen by reducing unit cost and improve coordination and cooperation between agents of the systems. Up to now, the competitiveness is based on the rather favorable agro-climatic environment and the

proximity of the exporting market. Strengthening the current position of Syrian citrus production on the middle income segment of consumers would require upgrading the capacity of the sector to manage large volume that is beyond the capacities or major exporters

10. The qualities versus the mass market strategies are not necessarily in opposition. The implementation of both options would require investing in human resources development and the establishment of institutions that facilitate the coordination among actors. However, the “mass market” strategy might be easier to implement in the short run as tit would be less demanding in terms of capacity building and would be more inclusive in terms of number of citrus value chain agent concerned. The development of high quality sub-chain targeting more demanding market where competition from major world exporters occurs could be based on the experience acquired by both private and public institutions in strengthening of the current Syrian citrus exports market.
11. Providing support to the citrus farmers and stimulating them to expand biological pest control.
12. Focusing on packaging, stowing, and product homogeneity in addition to storing, refrigerating, and quality to achieve economic profitability and compete in world markets taking into account the final destination of citrus products (export, domestic marketing or juice processing).
13. Conducting studies on all potential markets that may pay greater prices (mainly EU markets) and focusing on consumer preferences in such markets and focusing on production surpluses from the most important exporting varieties that can be exported.
14. Importing refrigerating trucks according to the International Transit Agreement.
15. Establishment marketing cooperatives that specialize in citrus fruit marketing and support them.
16. Providing support to the exporters in addition to enhance the role of exporters union which has been established recently.
17. Completing the final Syrian – European Association Agreement in order to benefit from its advantages and focusing to overcome the trade barriers with EU countries (protectionist policies).

Appendix 1

Agro-climatic zones in Syria

Zone 1:	**With an average annual precipitation of more than 350 mm. The total area of this zone (2.7 million hectares) represents 15% of the total area of the country and includes 1.57 million hectares of cultivated land (about 28% of the total) and 60% of pastoral land. It is subdivided into two sub-zones:** **1. Sub-zone with annual rainfall greater than 600 mm, where rain-fed crops are grown without any risk.** **2. Sub-zone with rainfall between 350 and 600 mm where only two seasons out of three are, on average, suitable for rain-fed cultivation with no risk.** **This zone can be mainly cultivated with wheat, legumes, and summer crops (cotton, potato, tomato).**
Zone 2:	With average annual rainfall between 250 and 350 mm. Two out of three seasons are secured in this zone. Its total area (2,473,000 hectares) represents 13% of the total country's area and includes 30% of the total cultivated land. The actual cultivated area in this zone in 2006 was 1,571,000 hectares, out of which 225,000 hectares were planted with fruit trees and 1,346,000 hectares with field crops (mainly barley, wheat, legumes, and summer crops); The common rotations in this zone are: 1. On deep soil: wheat-pulses and forage legumes – a summer crop is planted if winter rain is sufficient, otherwise fallow will take the place of summer crop. 2. On shallow soil: mainly barley, but part of the land is planted to cumin. Fallow is rare. The area of this zone is 2,470,000 hectares and it forms 13.3 % of the country's area.
Zone 3:	With average annual rainfall greater than 250 mm in more than half of the seasons. The total area of the zone is 1,306,000 hectares representing 7% of Syria's total area. In 2006 the actual cultivated area in this zone was 613,000 hectares, of which 76,000 hectares were devoted to fruit trees while the remainder was planted with field crops (barley, lentils, and chickpeas); the main crops is barley, although legumes could be planted. Fallow is practiced in case of capital shortage. The area of this zone is 1,306,000 hectares and it forms 7.1 % of the country's area.
Zone 4:	With average annual rainfall between 200 and 250 mm in more than half of the seasons. The area under this zone is about 1,833,000 hectares representing 10% of the total country's area. The actual cultivated area in 2006 reached 665,000 hectares, out of which 37,000 hectares were planted with trees and 685,000 hectares were planted with field crops (maize, wheat, barley, lentils, and chickpeas); it is good just for barley, which in some years is grazed as the yield is too low to harvest. Fallow is practiced in case of capital shortage. The area of this zone is 1,833,000 hectares and forms 9.9 percent of the country's area.
Zone 5:	with an average annual rainfall of less than 200 mm distributed in more than half of the seasons. It consists of rangelands and desert areas and covering 10 208,000 hectares representing about 55% of the total area of the country. This zone includes 86% of the pastoral land is not suitable for rain fed cultivation. It is natural grazing for sheep and camels.

Source: Own table based on SMAAR database.

Appendix 2

Exchange rates of foreign currencies at official market prices and neigh-boring countries 2007, 2008, and 2009; Unit: Syrian Pounds (SP)

	2007 December	2008 December	2009 December
Period Average			
Exchange Rates (SP per $)			
Official Exchange Rate	11.2	11.2	11.2
Exchange Rate ($)	50.0	46.5	46.7
Foreign Currency Exchange Rate			
Euro €	68.5	68.4	65.1
Sterling Pound £	100.1	86.2	73.0
Japanese Yen(100 Yen) ¥	42.5	44.9	49.9
Saudi Riyal	13.4	12.4	12.5
Jordanian Dinar	70.8	65.3	66.3
Lebanese Pound	0.033	0.031	0.031
Egyptian Pound	8.9	8.5	8.4
Turkish Pound	38.3	36.1	30.2
Syrian pound against SDR	**76.5**	**73.5**	**72.0**
US Dollar against the Major Foreign currencies			
Special Drawing Rights (SDR)	1.53	1.58	1.54
Euro €	1.38	1.47	1.39
Sterling Pound £	2.01	1.85	1.56
Japanese Yen (100yen) ¥	0.85	0.97	1.07
Swiss Franc	0.84	0.92	0.92
End of Period			
Exchange Rates (SP per $)			
Official Exchange Rate	11.2	11.2	11.2
Exchange Rate ($)	48.1	46.4	45.7
Foreign Currency Exchange Rate			
Euro €	70.9	65.4	65.9
Sterling Pound £	96.1	67.2	73.7
Japanese Yen (100 Yen) ¥	43.0	51.1	49.5
Saudi Riyal	12.9	12.4	12.3
Jordanian Dinar	68.3	65.1	64.9
Lebanese Pound	0.032	0.031	0.030
Egyptian Pound	8.7	8.4	8.3
Turkish Pound	41.3	30.2	30.6
Syrian pound against SDR	**76.0**	**71.4**	**71.6**
US Dollar against the Major Foreign currencies			
Special Drawing Rights (SDR)	1.58	1.54	1.57
Euro €	1.46	1.41	1.43
Sterling Pound £	1.98	1.44	1.61

Japanese Yen(100yen) ¥	0.90	1.11	1.09
Swiss Franc	0.88	0.95	0.96

Source: Own table depends on Central Bank of Syria Data and (CBS, 2010).

Appendix 3

Irrigation Intervals (days) [1]

Irrigation method	Traditional open furrow irrigation		Sprinkler	Drip	
Orchard age / Soil type	Young	Mature	Mature	Young	Mature
Light	7	According to the growth periods	7	1	1
Medium	7-12		10	2	3-4
Heavy	8-12		14	3	1-5

[1] The appropriate time of citrus trees irrigation could be determined by one of the following methods:

1. Cultivation of function plants in the citrus fruits orchards like corn and sunflower: The wilting point of their leaves indicates that the field capacity is low, and hence the humidity will not appear on the citrus trees. Therefore the trees will derive their need of moisture from fruits.
2. Through small new citrus leaves: A new leaf is taken, folded and pressed by hand. If it is broken, the trees need irrigation water, if not, then the trees do not need irrigation water.
3. It is important to use additional parameters to determine irrigation schedule like: soil sampling auger, tension-meters, and by measuring fruit size

Source: Own table based on CBD, Extension Program for Citrus Fruit Cultivation, 2005.

Appendix 4

Drip irrigated young citrus orchard (up to 4 years from planting) [1]

	L/tree/day							Emitters/tree
	Spring	**Late spring**	**Early summer**	**Summer**	**Late summer**	**Early fall**	**Fall**	
1st Year	1	2	3	4	5	5	5	1
2nd Year	10	10	10	12	15	15	15	3
3rd Year	15	20	22	25	25	25	20	All emitters open
4th Year	20	25	30	40	40	40	30	

[1] The water quantities are per single tree and related to irrigation method

Source: Own table depends on CBD, Extension Program for Citrus Fruit Cultivation, 2005.

Appendix 5

The net requirements of water for citrus trees during the hottest months in Syria

Province	Month / Items	May	June	July	August	September	SUM (m^3/hectare)
Latakia	The maximum quantity of evaporation	1364	1740	1860	1829	1500	8493
	The net requirements of water for mature trees (m^3/hectare)	655	1130	1400	1310	815	5310
	The net requirements of water for seedlings (m^3/hectare)	385	780	920	855	440	3380
Tartous	The maximum quantity of evaporation	1349	1575	1782	1736	1500	7942
	The net requirements of water for mature trees (m^3/hectare)	600	1075	1335	1160	685	4855
	The net requirements of water for seedlings (m^3/hectare)	335	670	900	730	325	3050

Source: Own table depends on CBD, Extension Program for Citrus Fruit Cultivation, 2005.

Appendix 6

Quantities [1] of fundamental fertilizers should be added to the citrus tree (up to 10th year from planting [2]); gram/tree

	Additions number	Pure Nitrogen	Ammonium nitrate (33,5%) [3]	Pure Phosphorus	Super phosphate	Pure potash	potash sulfate 50%
1st Year	5	100	333	25	50	50	100
2nd Year	4	200	666	50	100	100	200
3rd Year	4	300	999	75	150	150	300
4th Year	3	400	1322	100	200	200	400
5th Year	3	500	1665	125	250	250	500
6th Year	3	600	1998	150	300	300	600
7th Year	3	700	2231	175	350	350	700
8th Year	3	800	2664	200	400	400	800
9th Year	3	900	2997	225	450	450	900
10th Year	3	1000	3330	250	500	500	1000

[1] These quantities are calculated according to the following fertilizer equation: (**1*N*:1/4*P*:1/2*K***). The potash and phosphorus fertilizers are added in the autumn (November), while the nitrogen fertilizer is added in three batches: in the first one, the half of the nitrogen amount is added at the beginning of February (1st – 10th day). In the second one, the quarter of the nitrogen amount is added at the end of May and the beginning of June (25.05-05.06). In the third one, the rest of the nitrogen amount is added at the end of July and the beginning of August (25.07-05.08). Micronutrients (*Fe*, *Zn*, *Mn*, *B*, *Cu*, *Mo*, *Ni*, and *Cl*) are needed by the citrus trees in very small quantities, so-called rare nutrients. The compounds of these elements need to be sprayed with water on the citrus trees leaves (according to specific percentages), either when the deficiency symptoms of these elements are appeared on the different plant parts (most frequently on leaves, fruits, and roots) or by leaf analysis.

[2] At the 10th year from planting, citrus trees reach the maximum produce of fruits.

[3] This sort is the best azotic fertilizers for citrus tree as it melt easily and is quickly absorbed by the roots of trees; therefore it fully recommend to use it in the process of citrus fertilization in Syria.

Source: Own table depends on CBD, Extension Program for Citrus Fruit Cultivation, 2005.

Appendix 7

Pruning process of some of the important citrus species cultivated in Syria. A brief explain

Citrus Species	Explanation
1. Oranges	Orange tree requires very little pruning, this process is summarized in the following aspects: 1. In order to keep the tree free from dead and unproductive portions, the lower limbs are pruned. Furthermore, under wet conditions like in the coastal regions in Syria where annual rainfall is high, the lower portion of tree needs to be well-exposed and aerated for quick drying up. 2. It is important to retain and manage tree height. The continuous development in the top part of the tree is maintained at the cost of the growth in lower parts. A balance between top and root of the orange trees is established, when they are cultivated in a particular soil and managed with particular cultural practices. At this equilibrium, the roots will not support any increment in the tree canopy. Therefore, the tendency of the bearing surface will decline due to the absence of new growth. The only alternative remaining is to prune some of the older parts so as to let the tree to make sufficient renewal growth. 3. The internal part of the orange trees has to keep open; therefore, only three to four scaffold limbs are selected from the beginning of cultivation. In the case of full grown trees, their tops are pruned lightly to enable sufficient light to get in the internal part of the trees. 4. Orange's growers avoid too much pruning because it is harmful. 5. Generally, it is necessary to remove the water sprouts as they are vigorous and upright branches. However, they may be retained, if they have grown long and exist in the upper portion of the tree. 6. It is wrong practice when grower removes the large sucker tops from older trees.
2. Mandarins	Pruning in mandarins is done with the objective growth, as they are considered, to some extent, to be over-bearers and also alternate bearers. When growers prune some of the shoots, they will remove a part of the fruiting area, this helps maintaining regular cropping. They have also to remove the dried up branches which are located in the bottom of the tree.
3. Grapefruits	The formation of upright branches of the grapefruit trees is negligible, and their foliage is quite dense. Therefore, growers have to reduce the density of plant foliage sufficiently, In order to allow the light and air to enter the internal portion of the tree.
4. Lemons	1. The highest response to pruning is reduced in lemons trees in comparison with other citrus species. However, pruning has to be applied to the lemon tree in determinate amount in order to keep it compact. 2. The productivity of un-pruned lemons trees is more than the

	pruned ones, but the opportunity of breakage main branches as a consequence to its high load will be increased. 3. In lemons trees, large numbers of new water sprouts are produced more rapidly than new growths on other citrus species. Growers have to thin out some of these water sprouts if they are situated in wrong places, whereas others are headed back to keep the plants compact. 4. Under climatic conditions of Mediterranean, the lemons trees give additional growths for a longer period of the year; this requires regular pruning to be followed. 5. In un-pruned lemons plants large amounts of fruits ripen even before reaching harvesting size, whereas in pruned trees this disorder is not noted. Due to the maturity of lemons fruits have been found to be advanced by pruning. In general, the fruits from pruned trees are superior to those from un-pruned trees, although in latter case, the total yield may be higher.

Source: Own table depends on (Morales et al., 2000; Tucker et al., 1994; Kretchman and Krezdorn, 1961; Wright and Kelly, 2008; Fake, 2012; Dick, 2007; Pittaway, 2002; CBD, Extension Program for Citrus Fruit Cultivation, 2005).

Appendix 8

Classification of crops with respect to their tolerance to physical and mechanical damage caused by wind and/or wind-blown soil

Tolerant Crops [1]	**Barley, Buckwheat, Flax, Millet, Oats, Rye, and Wheat.**
Moderate Tolerance Crops [2]	Corn, Grain sorghum, Sunflower, and Sweet corn.
Low Tolerance Crops [3]	Apples, Avocados, Cherries, Grapefruit, Grapes, Lemons, Limes, Oranges, Peaches, plums, Pears, and Tangerines.
Very Low Tolerance Crops [4]	Alfalfa, Asparagus, Beans, Cane berries, Green Beans, lima Beans, Snap beans, Table beet, Sugar beet, Broccoli, Cabbage, Carrots, Celery, Cotton, Cucumbers, Eggplant, Flowers, Garlic, Green Peas, Kiwifruit, Lettuce, Muskmelons, Onions, Peanuts, Peppers, potatoes, Soybeans, Spinach, Strawberries, Tobacco, Tomatoes, Watermelons, and Young orchards [5].

[1] They are those crops which show little or no damage from the direct effects of wind and tolerate significant soil abrasion.

[2] They are those crops which have some tolerance to the whipping action of the wind and tolerate some soil abrasion.

[3] They are those crops which are subject to extensive damage due to the direct effects of the wind or wind related desiccation. Therefore they have unique design requirements of windbreaks. In general, established orchards need shielding to enhance pollination, protect buds and twigs from desiccation and breakage, protect fruit from injury and premature drop, and enhance spraying and other cultural activities and to provide protection from cool coastal winds and wind-blown soil. The level of protection required depends on the crop, the stage of crop development and the degree of risk to be assumed.

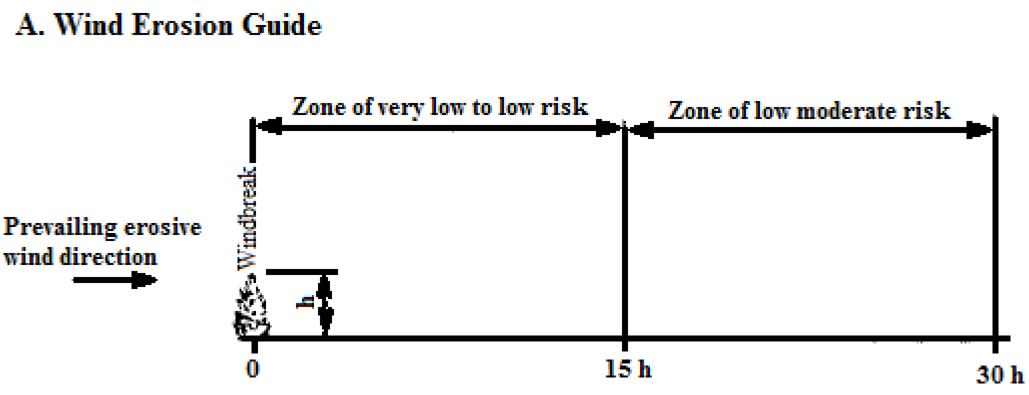
[4] They are those crops which are subject to extensive damage due to wind or soil abrasion.

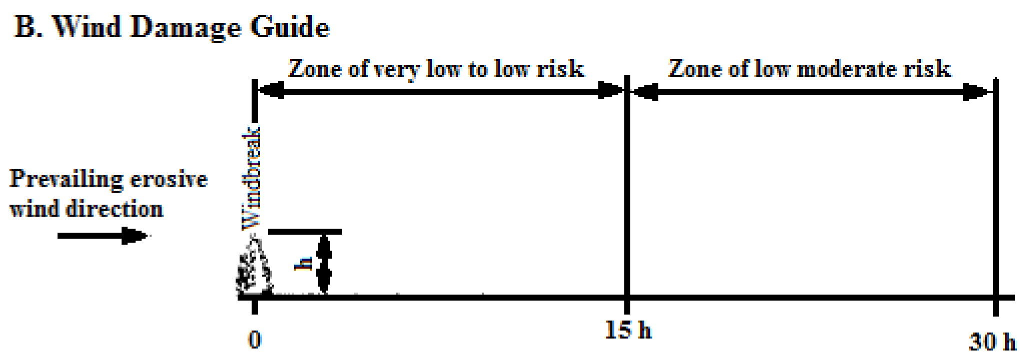
[5] Like: Citrus spp., Malus spp., Persica spp., Prunus spp., Pyrus spp. These young orchards were classified in this category because they are, even more than mature orchards, susceptible to damage caused by wind and/or wind-blown soil.

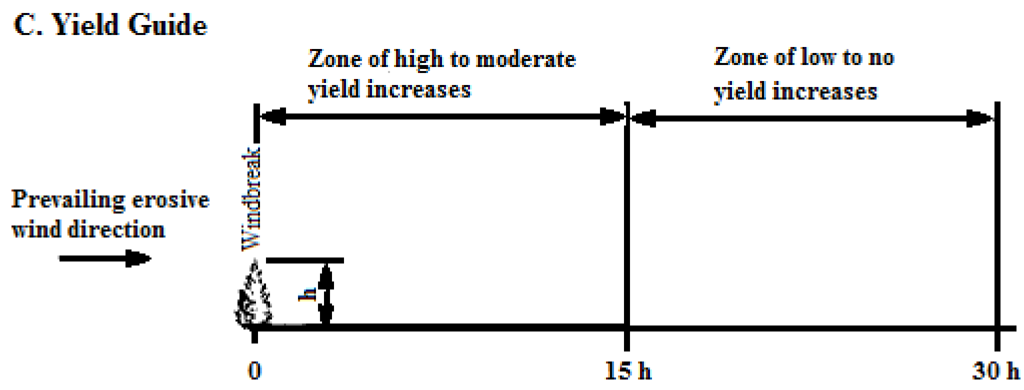
Source: Own table depends on (Finch, 1988).

Appendix 9

Risk and yield guide for tolerant crops [1]







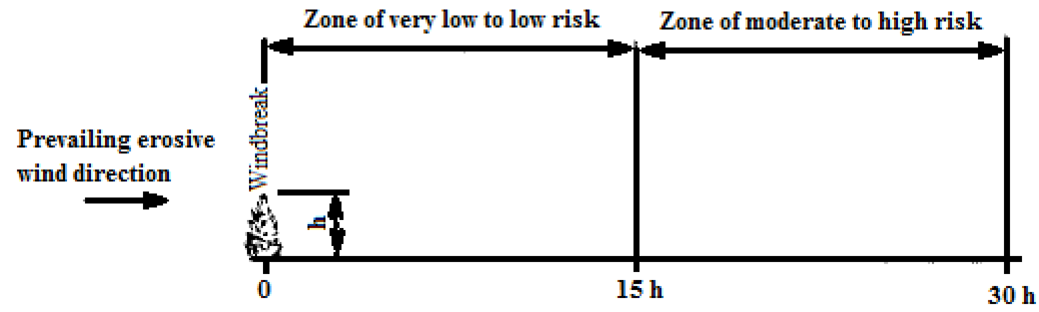
[1] In the wind erosion guide, this appendix indicates that within (0-15 h) there is a low risk of crop damage resulting from soil erosion. In the zone (15-30 h) the probability of soil erosion increases and the risk of crop damage associated with windblown soil increases. While in the wind damage guide, within (0-15 h) there is low risk of crop damage resulting from lodging or breakage of plant parts. In the (15-30 h) zone, risk damage increases. Spacing intervals can be reduced to further reduce the risk of wind-associated crop damage and enhance production. However, at narrower spacing intervals (< 10 h) the amount of land taken out of crop production may offset any crop production benefits.

Source: Elaborated from (Finch, 1988).

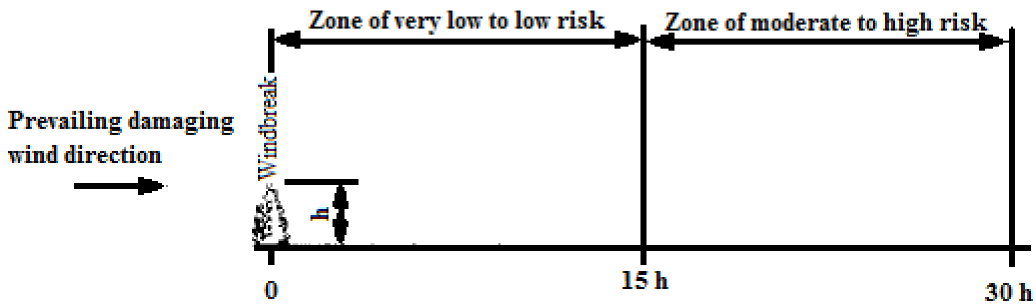
Appendix 10

Risk and yield guide for moderate tolerance crops [1]

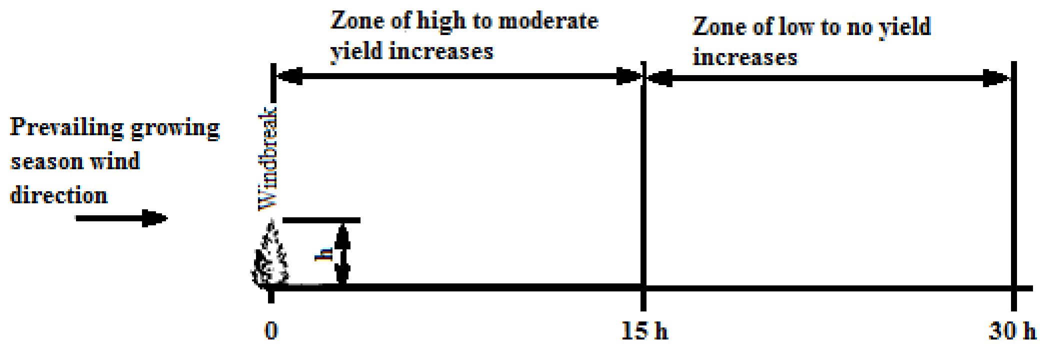
A. Wind Erosion Guide



B. Wind Damage Guide



C. Yield Guide

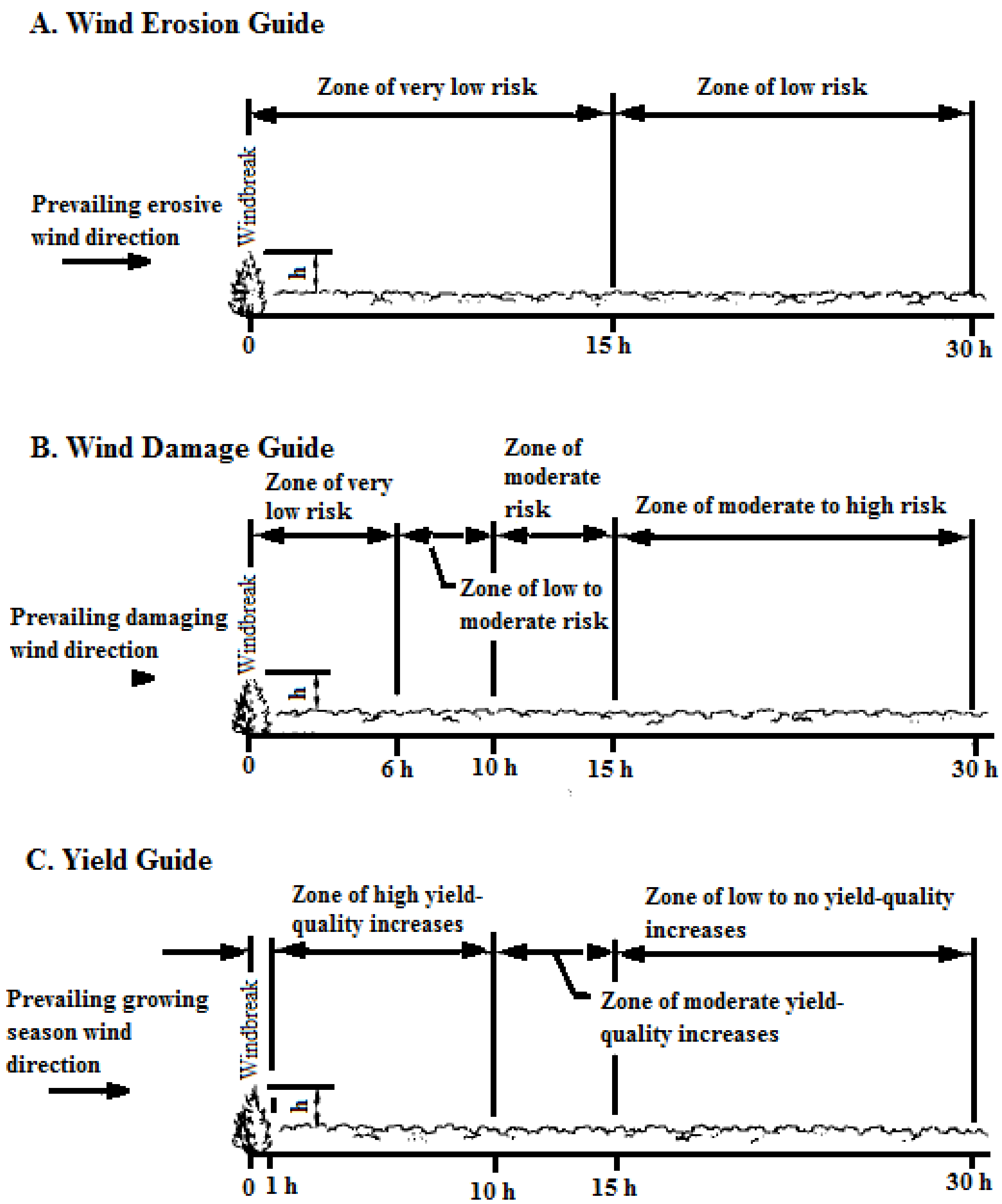


[1] Such crops are more susceptible to serious damage beyond the (15 h) zone than those in the tolerant category, especially on soil with sand, loamy sand, sandy loam or organic textures. Because these crops are somewhat more susceptible to wind-associated damage, some adjustments have been made in the risk and yield guides. In general, additional wind protection will be required to protect a given field.

Source: Elaborated from (Finch, 1988).

Appendix 11

<u>Risk and yield guide for low tolerance crops [1]</u>

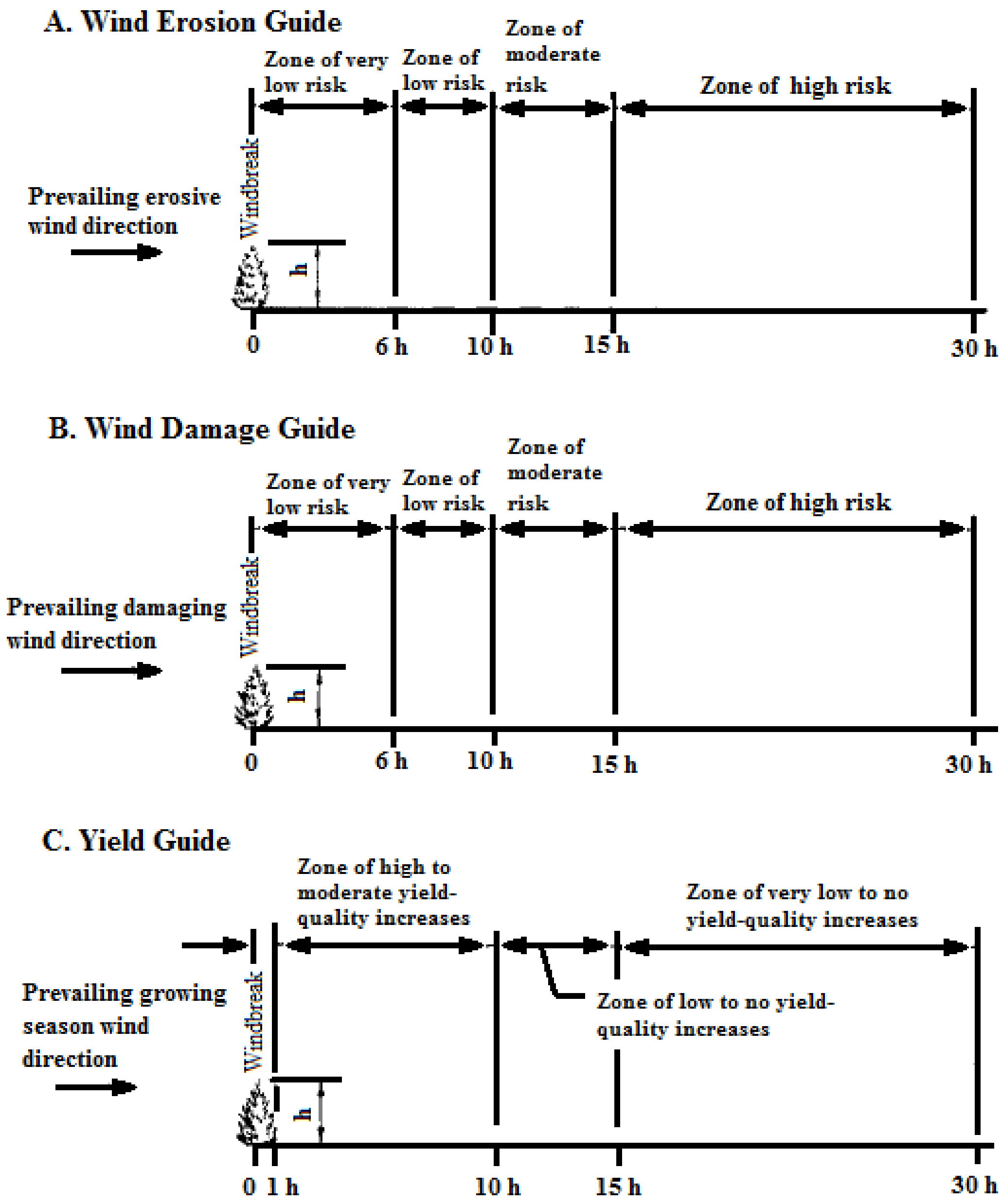


[1] This appendix shows the risk and yield guides for low tolerance crops. For many high-value orchard or vineyard crops a windbreak interval of (6-8 h) appears desirable. Wider intervals can be used wherever there is a willingness to accept a higher degree of risk for plant and crop damage. It is important to note that all windbreaks designed for orchards and vineyards should be at least two to three times as tall as the mature canopy height of the orchard or vineyard.

Source: Elaborated from (Finch, 1988).

Appendix 12

Risk and yield guide for very low tolerance crops [1]

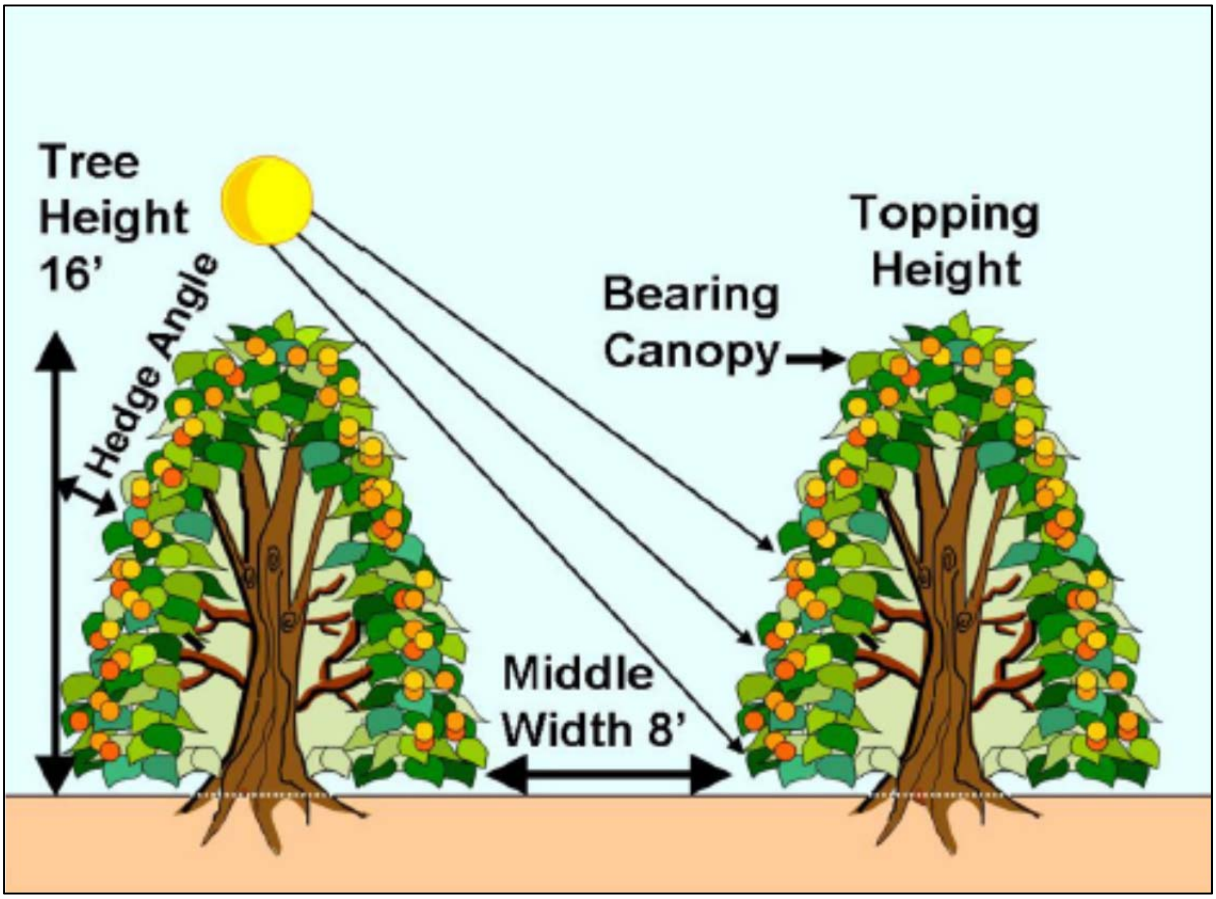


[1] The majority of crops in this category, including young orchards, has high or extremely high economic value and is highly susceptible to damage from wind or small amounts of wind-blown soil during some portion of growing season. Therefore, they require a very high level of wind protection. A spacing interval of (≤ 10 h) provides a high degree of protection from wind and maximizes the quality and quantity of the crops in this category.

Source: Elaborated from (Finch, 1988).

Appendix 13

The influence of middle width, topping height, and solar angle on the sunlight amount that gets to the lower canopy of citrus trees [1]

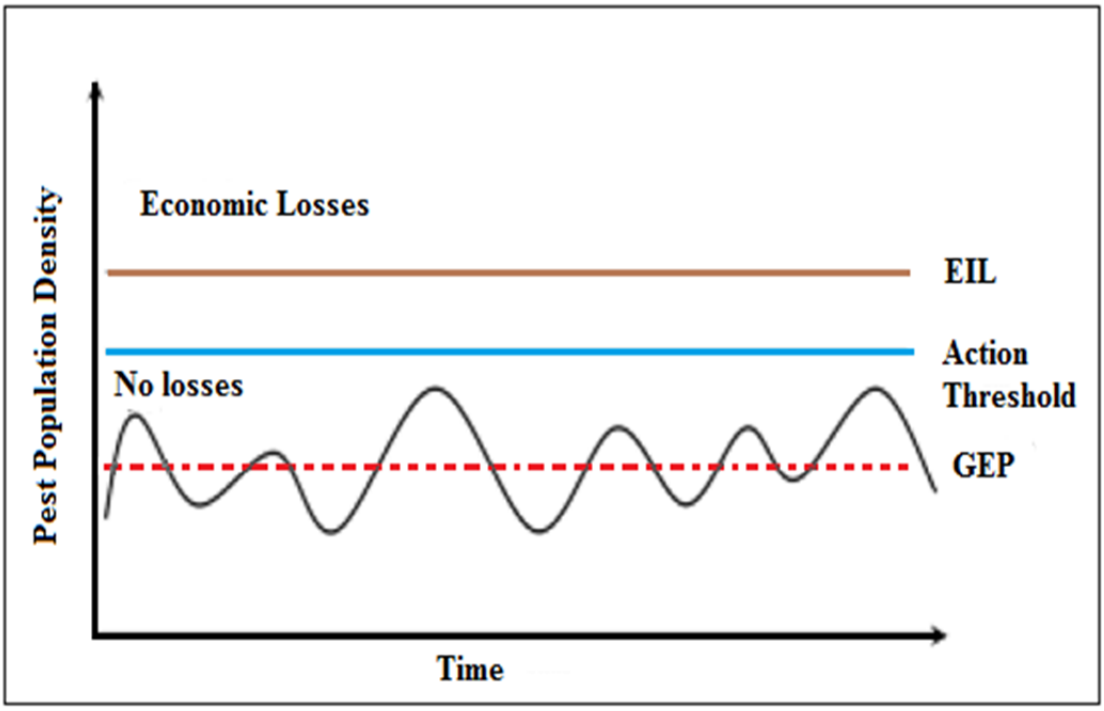


[1] An example about citrus tree spacing: with 8 feet middle width, trees would receive adequate light at the base if they were 16 feet tall.

Source: Elaborated from (Parsons and Wheaton, 2009).

Appendix 14

General Equilibrium Position (GEP) [1]



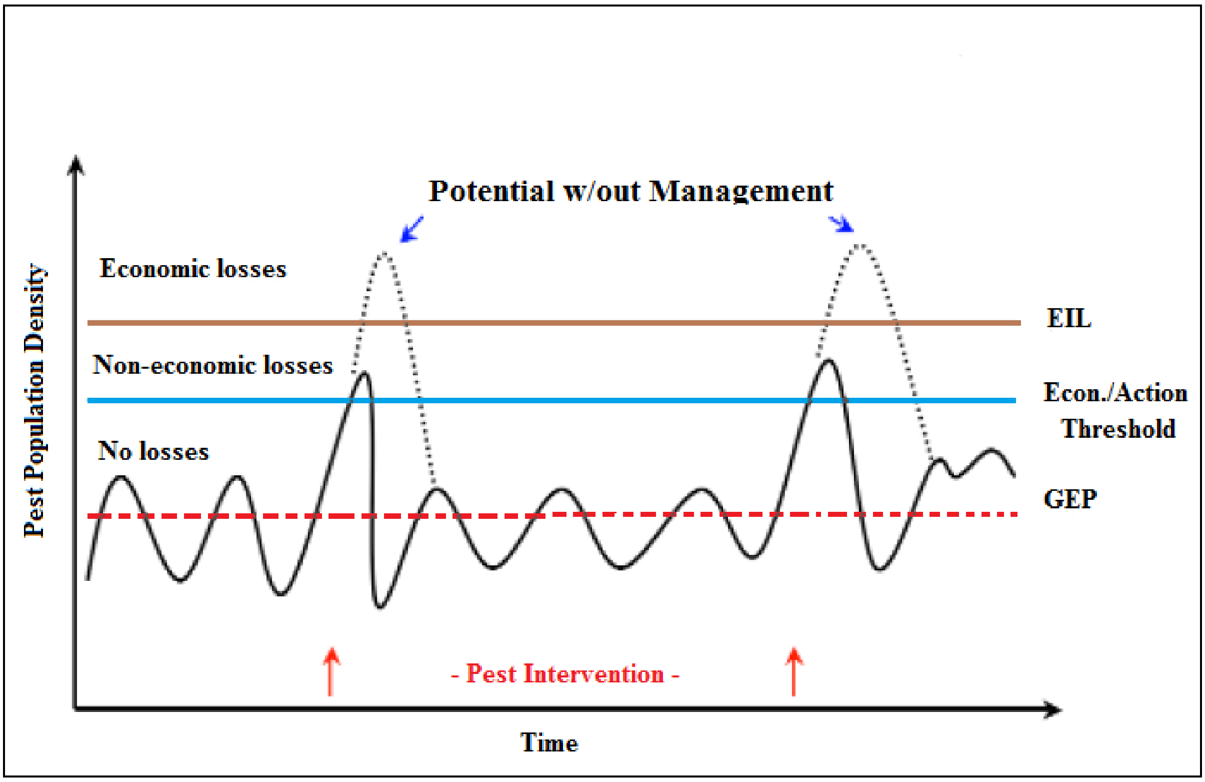
[1] **GEP:** It is the average population density of a pest over a long period of time, unaffected by interventions of pest management. This level fluctuates about a mean level as a result of biotic and abiotic regulating factors. For more information see the following websites:

1. Integrated Pest Management Overview, by: Galen Dively, University of Maryland. URL: http://mdipm.umd.edu/aboutIPM/overview.cfm.
2. Economic Injury Level, by: John R. Meyer, Department of Entomology. NC State University. URL: http://www.cals.ncsu.edu/course/ent425/tutorial/economics.html#1.

Source: Elaborated from (Hajek, 2004; Hann *et al.*, 2008).

Appendix 15

Pest Population Dynamics [1]: GEP, ET/AT [2], EIL



[1] In most crops, and most seasons, a pest species that feed on or otherwise affect the crop will be present at some points in the plant life cycle. However, just because the pest is present does not necessarily mean that the farmer needs to take action against the pest. "In seeking to reduce a pest's long term average density, the general equilibrium position (GEP), is low compared with the economic threshold (problems are not particularly severe), the best strategy would be to dampen pest population peaks. This action would not change the GEP appreciably, yet would prevent economic damage from occurring during outbreaks." By contrast, "severe pest problems call for more drastic population reductions. With these pest problems, the GEP lies very close to or is above the economic threshold. What is required for these populations is a general lowering of the GEP so that highest population peaks never reach the economic threshold."

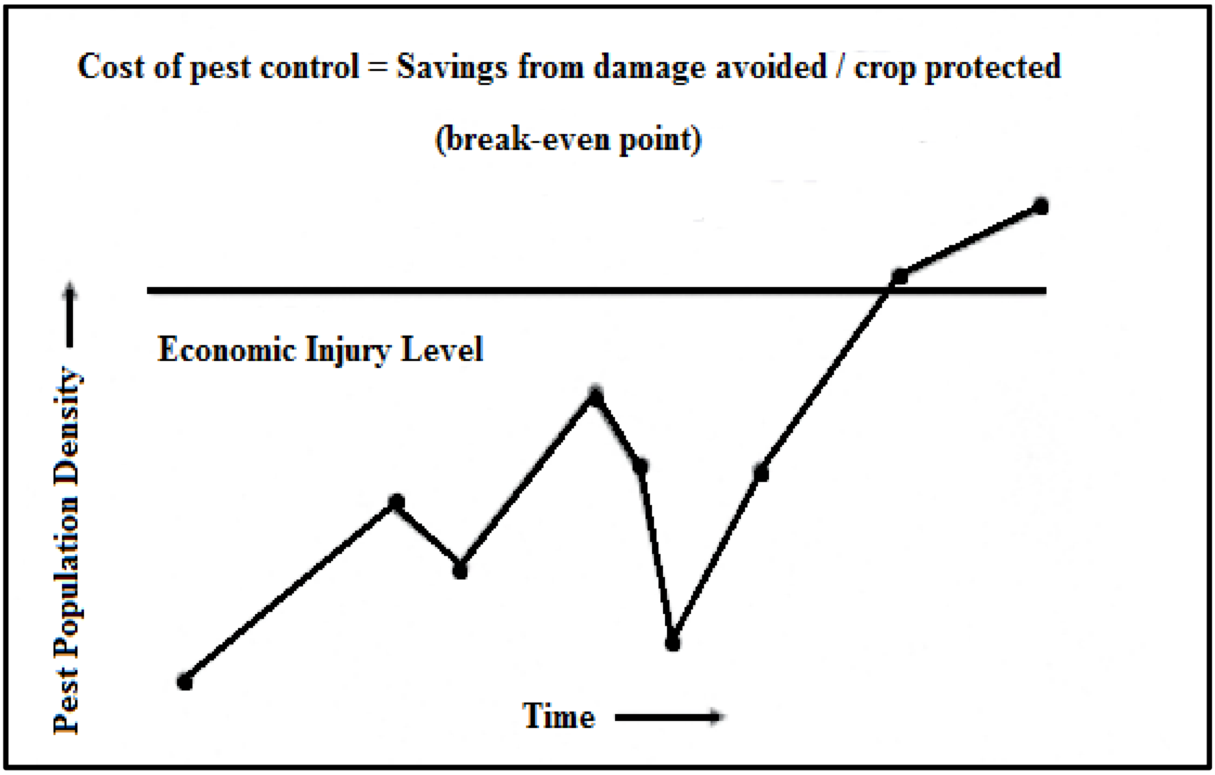
[2] **Action Threshold (AT):** It has the same meaning of Economic Threshold. For more information see the following websites:

1. Integrated Pest Management Overview, by: Galen Dively, University of Maryland. URL: http://mdipm.umd.edu/aboutIPM/overview.cfm.
2. Economic Injury Level, by: John R. Meyer, Department of Entomology. NC State University. URL: http://www.cals.ncsu.edu/course/ent425/tutorial/economics.html#1.

Source: Elaborated from (Hann *et al*., 2008).

Appendix 16

Economic Injury Level (EIL) [1]



[1] **EIL:** Is a concept helps farmers to know when the number of pests in their crop is too many? And, is this number the same every year in all fields? That it is meaning that it allows the farmers to compare the value of the damage the number of pests in the field might do to the crop with the cost of taking action against the pest. In other words, is the cost of taking action (e.g. spray) more or less than the value of crop lost to the pest if no action is taken? Other definitions of EIL are:

1. "The pest population density where the cost of control equals the value of the damage prevented if a control treatment is applied."
2. "The lowest population density of a pest that will cause economic damage; or the amount of pest injury which will justify the cost of control."

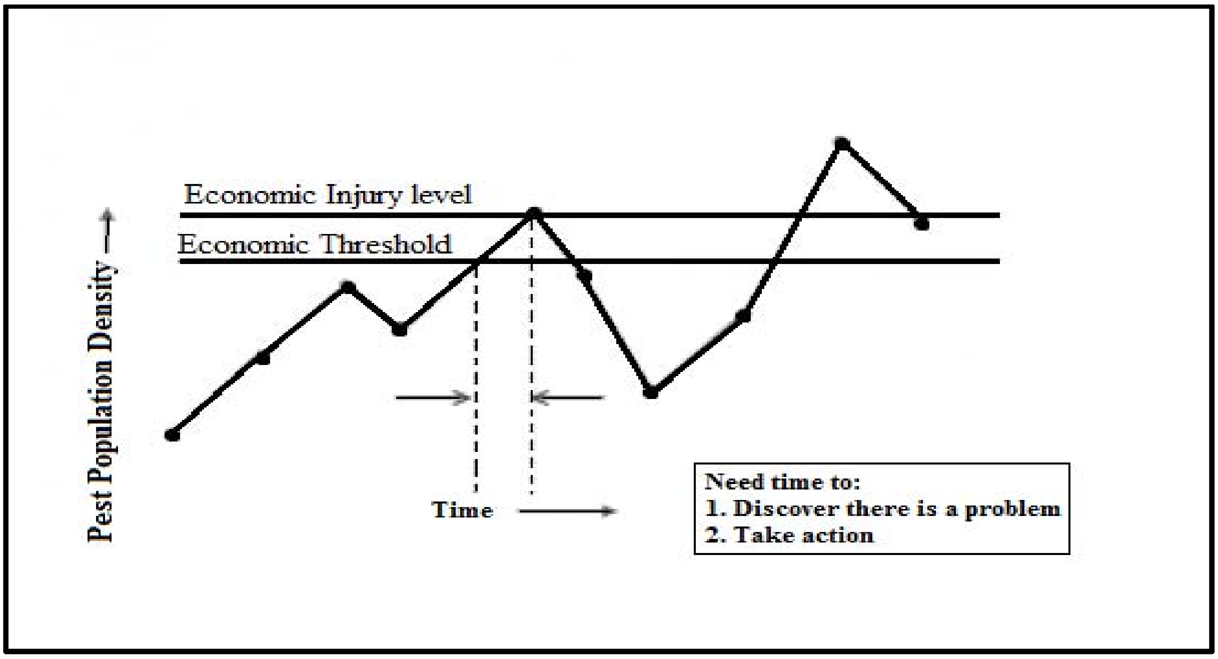
For more information see the following websites:

1. Integrated Pest Management Overview, by: Galen Dively, University of Maryland. URL: http://mdipm.umd.edu/aboutIPM/overview.cfm.
2. Economic Injury Level, by: John R. Meyer, Department of Entomology. NC State University. URL: http://www.cals.ncsu.edu/course/ent425/tutorial/economics.html#1.

Source: Elaborated from (Hann *et al*., 2008).

Appendix 17

Economic Threshold (ET) [1]



[1] **Economic Thresholds (ET):** Pest density at which a control action must be taken to avoid economic loss. In other words, it is the level of pest infestation at which management action is justified. At or above this level, the probable loss from crop damage is greater than the cost of control. Below this level, the cost of control is greater than the savings from crop protection. These thresholds are pre-calculated by researchers, so all the farmers have to do is take a proper sample of the pest to answer the question: Are they above or below the Economic Threshold for pest X? To calculate Economic Threshold farmer must:

1. Know how to identify the pest.
2. Know how to sample the crop environment to assess level of infestation.
3. Know stage of crop development and how that relates to severity of damage.
4. Know approximate economic threshold levels (available from farmer Governmental Extension Boards).
5. Consider how action threshold may vary with stage of crop development, value of crop and cost of control.

For more information see the following websites:

1. Integrated Pest Management Overview, by: Galen Dively, University of Maryland. URL: http://mdipm.umd.edu/aboutIPM/overview.cfm.
2. Economic Injury Level, by: John R. Meyer, Department of Entomology. NC State University. URL: http://www.cals.ncsu.edu/course/ent425/tutorial/economics.html#1.
3. ***Source:*** Elaborated from (Hann *et al*., 2008).

Appendix 18

Biological control program of citrus pests in Syria

	The pest name		Natural enemies & control	Notes
1.	Common	Red scale	*Aphytis lingnanesis* *Encarsia gigas* *Comperiella bifasciata*	Native Native Native
	Scientific	*Aonidiella aurantii*		
2.	Common	Brown soft scale	*Encyrtus sp.*	Native
	Scientific	*Coccus hesperidum*		
3.	Common	Wax scale	*Coccophagus sp.* *Scutellista cyanea* *Aprostocetus toddalia*	Native Native Native
	Scientific	*Ceroplastes sinensis*		
4.	Common	Mealy bugs	*Cryptolaemus montrouzieri* *Leptomastix dactoloppi* *Pachyneuron muscarum* *Clausenia purpurea* *Anagyrus agraensis*	Intro. from Turkey and Holland 1994-95 Native Native Native
	Scientific	*Pseudococcus adonidum* *Planococcus citri*		
5.	Common	Citrus whitefly	*Encarsia armata*	Native
	Scientific	*Dialeurodes citri*		
6.	Common	Wooly Whitefly	*Cales noackie*	Introduced from Italy 1992
	Scientific	*Aleurothrixus floccosus*		
7.	Common	Waxy whitefly	*Eretmocerus debachi*	Native and introduced from Turkey 1994
	Scientific	*Parabemisia myricae*		
8.	Common	Minio whitefly	*Encarsia hispida*	Native
	Scientific	*Paraleyrodes minieo*		
9.	Common	Citrus rust mite	*Phytoseides sp.*	Native
	Scientific	*Phyllocoptruta oleivora*		
10.	Common	Citrus red mite	*Phytoseides sp.* *Amplyseius californicus*	Native Intro. from Holland 1995
	Scientific	*Panonychus citri*		
11.	Common	Citrus bud mite	*Phytoseides sp.*	Native
	Scientific	*Aceria sheldoni*		

12.	**Common**	**Citrus leafminer**	***Ratzeburgiola incompleta* *Cirrospilus sp. nr. lyncus* *Neochrysocharis sp.* *Sternomesius sp.* *Ageniaspis citricola* *Cirrospilus quadristriatus* *Semilacher petiolatus* *Sympiesis sp.***	**Native Native Native Native Intro from Australia 1995 Intro from Australia 1995 Intro from Australia 1995 Intro from Australia 1995**
	Scientific	***Phyllocnistis citrella***		
13.	**Common**	**Citrus flower moth**	***Bracon hebetor* *Elasmus stiffani* *+ Traps***	**Native**
	Scientific	***Prays citri***		
14.	**Common**	**Mediterranean fruit fly**	***Diachasmonerpha tryoni* *+ Pheremones (T.M.L)***	**Introduced from Reunion Island 1996**
	Scientific	***Ceratitis capitata***		
15.	**Common**	**Black citrus aphid (Boyer de Fonscolombe)**	***Aphidoletes aphidimyza* *Scymnus sp.* *Syrphus sp.* *Chrysopa sp.* *Coccinella septempunctata***	**Native**
	Scientific	***Toxoptera aurantii* *Aphis citricola* *Aphis gossiypii***		

Source: Own table based on Citrus Researches Section, (CBD, 2001) and (Kerns *et al*., 2004).

Appendix 19

Copy of a fax[1] includes the results[2] of residual pesticides analysis in a sample of Syrian Navel orange according to SICAGRO laboratory, France

Fax émis par : 33 140 28 30 14 POMONA IMPORT A4->A4 13/11/96 17:09 Pg: 1/3

pomona import 21, rue du Pont-Neuf - 75039 Paris Cedex 01 - Tél. 40.28.30.00

cc MrKBD, MH

FAX

Paris, le 13/11/1996

Message à l'attention de Monsieur DOUGHAN

de la part de M. SCHWARTZ

Cher Monsieur Doughan,

Les résultats des analyses réalisées par le laboratoire SICAGRO confirment la conformité de l'échantillon de Navel à la législation sur les résidus de pesticides.

Le seul résultat positif concerne les Benzimidazoles et plus particulièrement le Bénomyl, nécessairement utilisé en culture pour aider la conservation du fruit après récolte. La teneur maximale autorisée pour les agrumes est de 5 mg/kg.

L'absence d'autres résultats positifs donnent l'indication claire que les procédures de lutte intégrée sont appliquées.

Dans ces conditions, nous sommes encouragés à examiner les conditions dans lesquelles nous pourrions réaliser un essai significatif.

Pouvez-vous nous faire un point sur l'évolution de la production et de la récolte et sur les moyens de transport envisageables ?

Vous en remerciant, veuillez agréer, Cher Monsieur Doughan, l'expression de mes meilleures salutations.

M. SCHWARTZ

S.A.R.L. AU CAPITAL DE 700.000 FRANCS
R.C. PARIS B 562 129 585
ADRESSE TÉLÉGRAPHIQUE : STOCKFRUITS-PARIS
TÉLEX 220 997 - POMONA PARIS - C.C.P. PARIS 8.952.00
TÉLÉCOPIE 40 26 58 95

SICAGRO
LABORATOIRE

6, Rue Jean Moulin
45073 ORLÉANS Cédex 02
✆ 38 56 54 69
Fax 38 51 30 88

POMONA IMPORT

21 Rue du Pont-Neuf

75039 PARIS CEDEX 01

24 OCT. 1996

Orléans, le 21 octobre 1996

Echantillon: ORANGES NAVEL (provenance Syrie)
D9603018

Organochlorés en mg/kg (ppm)	Seuil de détermination	Résultats positifs
HCB	< 0.001	
HCH	< 0.001	
Lindane (gamma HCH)	< 0.001	
Heptachlore	< 0.001	
Aldrine	< 0.002	
Dieldrine	< 0.005	
Endrine	< 0.005	
Endosulfan	< 0.005	
Chlordane	< 0.001	
DDT & composés voisins	< 0.05	
Organophosphorés en mg/kg (ppm)	**Seuil de détermination**	**Résultats positifs**
Malathion	< 0.01	
Chlorpyriphos méthyl	< 0.01	
Pyrimiphos méthyl	< 0.005	
Diazinon	< 0.005	
Dichlorvos	< 0.01	
Fénitrothion	< 0.01	
Trichlorfon	< 0.05	
Chlorpyriphos-Ethyl	< 0.005	
Parathion-Méthyl	< 0.01	
Parathion-Ethyl	< 0.01	
Pyrimiphos-Ethyl	< 0.01	
Chlorfenvinphos	< 0.01	
Déthion	< 0.01	
Diméthoate	< 0.05	
Dichlofenthion	< 0.01	
Thiométon	< 0.005	
Fonofos	< 0.01	

mis par : 33 148 28 30 14 POMONA IMPORT A4->A4 13/11/96 17:09 Pg: 3/3

SICAGRO
LABORATOIRE

6, Rue Jean Moulin
45073 ORLÉANS Cédex 02
✆ 38 56 54 69
Fax 38 51 30 88

Orléans, le 21 octobre 1996

Echantillon: ORANGES NAVEL (provenance Syrie)
D9603018

Pyréthrynoïdes de synthèse en mg/kg (ppm)	Seuil de détermination	Résultats positifs
Cyperméthrine	< 0.005	
Deltaméthrine	< 0.005	
Fenvalérate	< 0.005	
Lambda Cyhalothrine	< 0.005	
Perméthrine	< 0.005	
Tétraméthrine	< 0.005	
Dithiocarbamates en mg/kg (ppm)	Seuil de détermination	Résultats positifs
	< 0.2	
Benzimidazoles en mg/kg (ppm)	Seuil de détermination	Résultats positifs
Bénomyl - Carbendazime Thiabendazole - Thiophanate méthyl exprimé en Carbendazime	< 0.05	2.12
en mg/kg (ppm)	Seuil de détermination	Résultats positifs
Imazalil	< 0.01	
Aldicarbe	< 0.01	
Foséthyl d'Aluminium	< 0.05	
Bromopropylate	< 0.01	
Orthophényl phénol	< 0.05	

Le Directeur,
J. COURMONT

[1] It was a report sent from Pomona Import, Paris in 13.01.1996 to Syrian Citrus Board.

[2] These results confirmed that the sample was free of the impact of residual pesticides; therefore it was identical to the legislation of the pesticide residues. Also, the report recommended the Syrian side to hold further studies about the use of biological control and its impact on the production of Syrian citrus fruit.

Source: (CBD, 2005).

Appendix 20

Monthly work program [1] to serve citrus orchards over the year according to the Syrian Citrus Board instructions

	Month	Work Program
1.	January	1. Follow-up the reaping of fruits of mature varieties except Valencia orange type and tangerine late maturity hybrids. 2. Pruning the broken branches and removing the dry and burn them, except the lemon type. 3. Follow-up the operations of organic and mineral fertilization (potash, phosphorus... etc.). 4. Cultivation of the new and previously formatted citrus groves. 5. Spraying lemon trees with different fungal disinfectants to protect them from mal secco disease. 6. Preparing seedbeds and planting seeds in the nurseries under plastic sheeting. 7. Taking special precautions to protect the orchards from frost risk. 8. Monitoring the process of draining the excess water (rain) from the orchards.
2.	February	1. Follow-up the reaping of fruits of medium maturity varieties (Jaffa, Mauardi, and grapefruit). 2. Control winter weed either by using surface hoeing or herbicides or manual weeding. 3. Monitoring lemon flower moth and put the attracting pheromones if the lemon flowers is bloomed. 4. Smoking the orchards in which frost is expected to occur. 5. Implementation of a sprinkle of preventive fungicides to protect trees from mal secco disease. 6. Implementation of a sprinkle of Bordeaux mixture [2] to prevent the bacterial blight.
3.	March	1. Start adding the first batch of nitrogen fertilizer. 2. Start the process of preparation the irrigation canals and digging dirt rings around the trees in order to avoid irrigation water contact with citrus trees trunks. 3. Follow-up the monitoring of lemon flower moth, if it exists, and put its own attracting pheromones. 4. Implementation of a remedial sprinkle of copper compounds for bacterial blight, if it exists. 5. Start the grafting of seedlings in the agricultural nurseries. 6. Follow-up weed control within citrus groves. 7. Transport the citrus seedlings from seedbeds to the pre-equipped bags in the agricultural nurseries.
4.	April	1. Follow-up the control of annual and perennial weed. 2. Reaping the fruits of Valencia orange. 3. Trees watering if no rain falls. 4. Follow-up grafting of seedlings within agricultural nurseries and citrus groves. 5. Implementation of a preventive sprinkle of fungal disinfectants from the mal secco disease on lemon types.

5.	**May**	1. Monitoring the emergence of citrus pests and insects and their development in orchards. 2. Orchards irrigation by an average of three times during this month: The volume of used water is estimated at 1364 m^3/hectare, this is equal to a period of irrigation of one and half hour per dunum. The abundance of water is 3 inches; this quantity is equal to (45 m^3/dunum). 3. Painting trees trunks with lime mixed with a material of copper in order to protect them from the injury of different types of lichens and to reduce the damages caused by sunlight. 4. Follow-up the process of grafting within agricultural nurseries.
6.	**June**	1. Follow-up watering by an average of 10% more than the previous month. 2. Start lemon trees pruning. The cuts should be smeared with protective healing mastic also the pruning residues should be burned to protect trees of mal secco disease. 3. Follow-up the process of grafting within agricultural nurseries and mature fields (in order to change cultivars). 4. Add the second batch of nitrogen fertilizer: one quarter of the total quantity. 5. Monitoring the citrus leafminer and use their specialized natural enemies.
7.	**July**	1. Follow-up the irrigation of citrus groves: the period between the irrigation and other is determined by the type of soil and the volume of used water is estimated by an average of (90 m^3/dunum); this is equal to a period of two hours per irrigation and the water abundance is three inches. 2. Monitoring the evolution of different insects that infect citrus trees by using their specialized natural enemies. 3. Treatment of citrus gummosis diseases either by spraying fungicides (Ridomil or Aliette), or by cutting out the diseased bark and painting the area with Bordeaux mixture. 4. Follow-up lemon trees pruning.
8.	**August**	1. Add the last batch of nitrogen fertilizer. 2. Watering orchards by the same quantities of used water during July. 3. The use of fruit fly traps which contained the specialized attracting pheromones. 4. Monitoring the citrus leafminer and use their specialized natural enemies.
9.	**September**	1. Monitoring the different citrus insects (scaly insects, whiteflies, spiders, fruit fly…etc.) and use the methods developed by Citrus Board in order to reduce their injuries. 2. Monitoring the citrus leafminer. 3. Watering citrus orchards by an average of (50 m^3/dunum) during each time. 4. Start plucking the fruits of early maturing varieties. 5. Follow-up the process of grafting within agricultural nurseries. 6. Follow-up the use of fruit fly's pheromones traps.
10.	**October**	1. Follow-up plucking the fruits of early maturing varieties.

		2. Follow-up the monitoring of fruit fly and the use of attracting traps. 3. Cleaning the drainage channels in citrus orchards before winter.
11.	**November**	1. Start the distribution of organic and mineral fertilizers (phosphorus and potash), under the vegetative canopy of the citrus trees. 2. Follow-up plucking the fruits of early maturing varieties. 3. Follow-up the monitoring of fruit fly and the use of their attracting traps. 4. Start the seedlings distribution program in the agricultural nurseries and centers to the citrus growers. 5. Planting windbreaks around the lands intended to be cultivated with citrus trees.
12.	**December**	1. Completion the distribution of organic fertilizer by an average of (3-5 tones/ dunum). 2. Completion the adding of phosphorus and potash fertilizers, if they had not been added during November. 3. Follow-up plucking the fruits of medium maturing varieties. 4. Spraying fungal disinfectants in order to protect trees from mal secco disease. 5. Reaping the fruits of many seeds cultivars, thence extract their seeds in order to prepare them to plant within the specialized seedbeds in the agricultural nurseries.

[1] This schedule of service work of citrus trees is not enough, therefore citrus growers have to make better use of the experiences and the instructions of citrus farming technicians, since each case has its own circumstances and each farm has special status. Notwithstanding, this program remains a work indicator helps each grower to remember the basic and necessary service operations within the citrus groves. As a result, the cooperation between farmers and agricultural engineers is the best way to create a sophisticated and modern agriculture.

[2] Bordeaux mixture: is a combination of the following natural minerals (1% lime, copper sulfate, and water). This mixture is an effective fungicide and bactericide used to control diseases of fruit, nuts, and ornamental plants. It also provides plants long-lasting protection against diseases, (Broome and Donaldson, 2010).

Source: Elaborated from (CBD, 2005) and interviews with citrus board experts in 2007.

Appendix 21

The effects of liberalizing decision, issued by Minister of SMAAR in 2009, on the fertilizers prices; prices are in SP per ton

	Price before Liberalizing	Price after Liberalizing	Increase Rate %
Superphosphate 46%	8160	23900	193%
Urea 46%	8900	18000	102.3%
Ammonium nitrate 33.5%	5800	15400	165.5%
Ammonium nitrate 30%	5800	8800	51.7%
Potassium sulfate 50%	12500	27500	120%

Source: Own table, based on data elaborated from an article issued in Arabic by "Damascus Center for Theoretical and Civil Rights Studies". Alahmad, Jaber. 17.09.2009. URL: http://www.dctcrs.org/s6953.htm.

Appendix 22

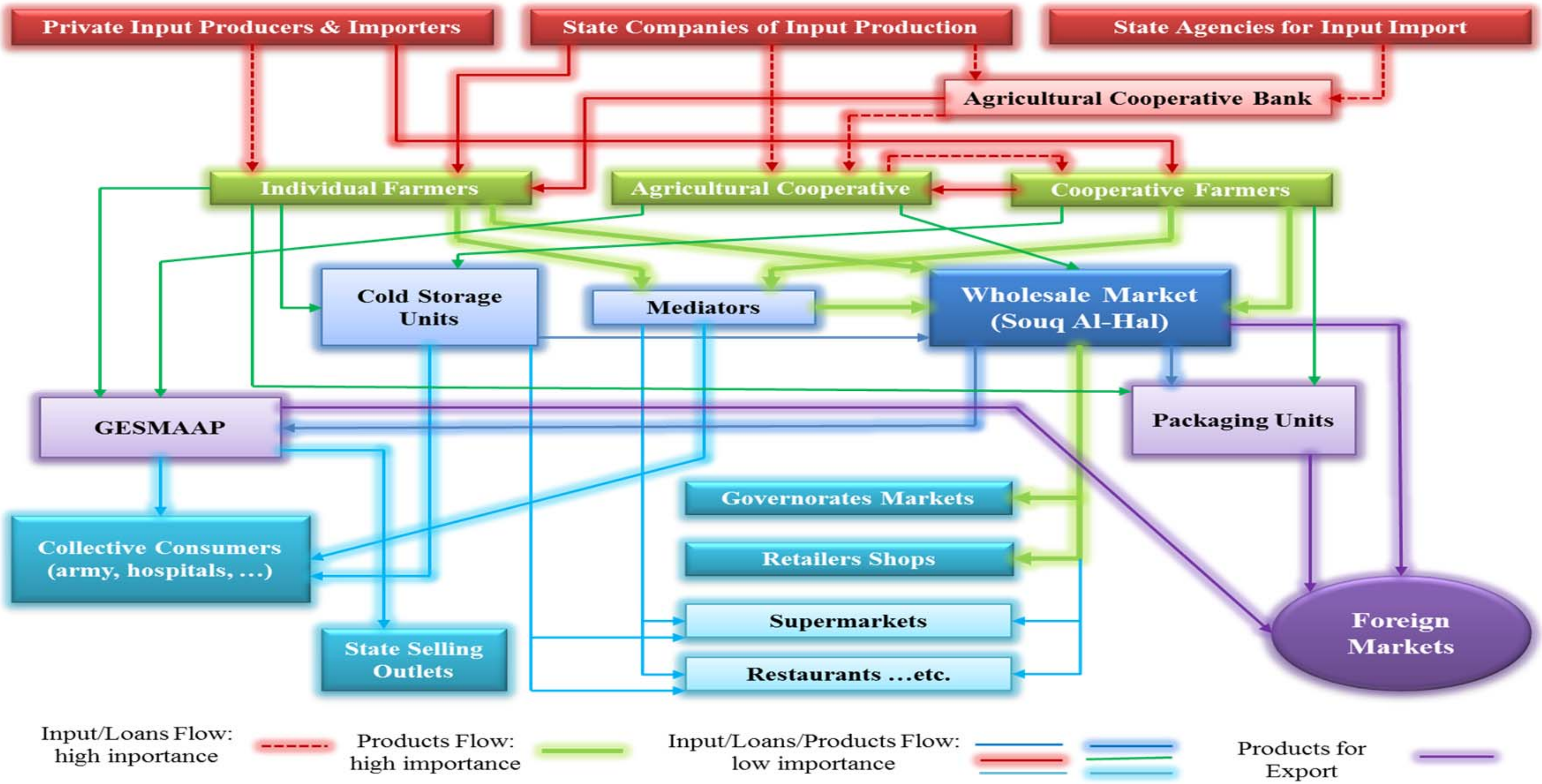
Loans offered by ACB according to some agricultural crops and inputs for 2010 & their development at the country level during 2006-2010 (Unit: 1000 SP)

Items	2006		2007		2008		2009		2010	
	In Cash	In Kind	In Cash	In Kind	In Cash	In Kind	In Cash	In Kind	In Cash	In Kind
Fruitful Afforestation	203741	85985	243682	78671	190523	61928	82877	42220	103776	42739
Olive	42873	42659	81596	40132	66840	52150	52117	50095	64189	88238
Cotton	1032303	637795	1022894	542808	2149187	468238	2159516	799131	8176105	752467
Cereals	1319124	3031217	1632052	2736290	931702	3368784	12255188	5770849	27858994	6322772
Sugar beet	111710	213097	71457	161879	97153	155151	105617	164013	132805	225043
Irrigation Projects	384327	15661	472406	7425	332841	5388	106502	733	111952	85
Vegetables	7700	1364	5986	524	16774	203	31158	265	57240	168
Green Houses	18652	-	18399	-	22737	673	34252	-	46096	570
Various Crops	10365	7206	1390	2643	486	25707	9611	7058	9383	2418
Potato	3192	218706	8915	190711	9021	244103	4611	146725	21036	87547

Source: own table elaborated from (AASA, 2010).

Appendix 23

The structure of citrus fruit market in Syria



Source: own figure based on (Alvarez-Coque *et al*., 2003).

Appendix 24

Index numbers (Laspeyres and Paasche)

There are lots of definitions have been given to index numbers by different authors:

1. *"Index numbers are used to aggregate detailed information on prices and quantities into scalar measures of price and quantity levels or their growth"* (Diewert, 2008; Diewert, 2006).
2. An index number is:" an economic data figure reflecting price or quantity compared with a standard or base value" (Diewert, 1987; Moulton et al., 1992). Usually, the base value equals 100 and the index number is expressed as 100 times the ratio to the base value.
3. Index numbers are relative numbers which are relative to the same quantity (or base). They are interested in reducing the data into purely relative numbers so that they can be used for comparisons (production, sales price, and employment or population changes over a certain period of time; also differences between regions or differences between comparable categories such as persons or commodities). According to this definition the index numbers relate to a variable or variables in a given period to the same variable or variables in another period, called the base period (Srivastava et al., 1989).
4. Index numbers are: "Devices for mitigating deceptions caused by changes in value of money" (Marris, 1958).
5. Index number, according to (Karmel, 1957): "represents the general level of magnitude of the changes between two or more situations of a number of variables taken as a whole".
6. Bowley (1926) gives the following definition to the index number: "index numbers are used to measure the change in some quantity which cannot be observed directly which we know to have a definite influence on many other quantities which we can so observe, tending to increase all or diminish all, while this influence is concealed by the action of many causes affecting the separate quantities in various ways".
7. Edgeworth (1925) defines index number as follows: *"a number adapted by its variations to indicate the increase or decrease of a magnitude not susceptible to accurate measurement"*.

There are several types of indices defined, among them Laspeyres' and Paasches' indices (Kenney and Keeping, 1962; Diewert, 1993):

1. Laspeyres' index: $$P_L = \frac{\Sigma\, p_n\, q_0}{\Sigma\, p_0\, q_0}$$

P_L defines the Laspeyres price index, where p_n is the price per unit in period $_n$ and q_0 is the quantity produced in the initial period.

2. Paasche's index: $$P_P = \frac{\Sigma\, p_n\, q_n}{\Sigma\, p_0\, q_n}$$

P_p defines the Paasche price index, where p_n is the price per unit in period $_n$ and q_n is the quantity produced in period $_n$.

Appendix 25

Evolution the total trade and the total agricultural trade between Syria and the countries of (GAFTA) during 2000-2009; Unit: million SP and %

Syrian Trade	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	AAGR%
Trade Size (million SP)											
Total Trade	60,736	71,626	94,989	83,755	128,627	129,614	281,098	362,421	482,810	373,939	**22.4**
Total Agricultural Trade	23,548	24,676	40,880	37,826	46,770	47,465	93,305	113,618	189,929	151,963	**23**
Agri. Trade/Total trade %	38.8	34.5	43.0	45.2	36.4	36.6	33.2	31.3	39.3	40.6	**0.5**
Import Value (million SP)											
Total Trade	25,759	34,255	28,251	28,417	54,053	61,068	92,182	134,978	130,060	117,465	**18.4**
Total Agricultural Trade	4,380	4,034	4,974	8,630	13,111	12,428	15,906	22,235	20,120	24,977	**21.3**
Agri. Trade/Total trade %	17.0	11.8	17.6	30.4	24.3	20.4	17.3	16.5	15.5	21.3	**2.5**
Export Value (million SP)											
Total Trade	34,977	37,371	66,738	55,338	74,574	68,546	188,916	227,444	359,718	256,474	**24.8**
Total Agricultural Trade	19,167	20,642	35,906	29,196	33,659	35,037	77,398	91,383	169,809	126,986	**23.4**
Agri. Trade/Total trade %	54.8	55.2	53.8	52.8	45.1	51.1	41.0	40.2	47.2	49.5	**-1.1**
Trade Balance (million SP)											
Total Trade	9,218	3,116	38,487	26,921	20,521	7,478	96,735	92,466	229,658	139,010	**35.2**
Total Agricultural Trade	14,787	16,608	30,932	20,566	20,547	22,609	61,492	69,148	149,690	102,009	**23.9**

***Source**:* Elaborated from the database of General Custom Directorate 2000-2004 in addition to CBS database between 2005 and 2010.

Appendix 26

World citrus fruits production during 1999-2009 by product; Unit: M.T.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Oranges	61921874	63793124	60067039	62037990	59666231	64845816	62832014	65880648	65693416	69751105	67594523	**0.9**
Mandarins, clementines ... etc.	20288752	18338561	20829653	21389661	22149445	23570379	23799882	26052985	20492635	21664865	21967158	**0.8**
Lemons and limes	10488399	11270902	12048279	12135172	12453988	12170186	12220285	13460139	13248069	13742739	14468803	**3.3**
Grapefruit (inc. Pomelos)	5061052	5423070	5156586	4899160	4815539	4999121	4038029	4442312	6457637	6726219	7032457	**3.3**
Citrus fruit, nes	6703417	6576471	6882671	7028485	7318751	7816479	8133533	7153016	9659795	10272267	11770353	**5.8**
Citrus fruit, Total	104463494	105402128	104984228	107490468	106403954	113401981	111023743	116989100	115551552	122157195	122833294	**1.6**

Source: Own table based on (FAOSTAT, 2010; FAOSTAT, 2011).

Appendix 27

World citrus fruit production in 2009 by country; Unit: M.T.

	Total citrus fruit
China	23,088,471
Brazil	19,752,262
United States	10,740,150
India	81,28,393
Mexico	7,124,577
Spain	5,240,100
Iran	4,138,700
Nigeria	3,769,420
Italy	3,745,000
Turkey	3,513,771
Egypt	3,295,495
South Africa	2,186,042
Morocco	1,763,037
Syria	1,092,622
Rest of the world	24,198,598

Source: Own table based on (FAOSTAT, 2010).

Appendix 28

World citrus fruit exports between 2006/07 and 2009/10 [1] by country and product; Unit: 1000 M.T. and %

	2006/07	2007/08	2008/09	2009/10	AAGR in %
Oranges exports in selected countries					
South Africa	934	971	869	1045	**3,8**
Egypt	620	850	774	850	**11**
United States	350	613	493	668	**24**
Turkey	179	155	256	209	**5**
EU	260	242	236	272	**1.5**
Other world countries	824	842	876	730	**-4**
Total	3167	3673	3504	3774	**6**
Lemons and limes exports in selected countries					
Turkey	328	220	351	434	**9.8**
Mexico	436	508	461	448	**0.9**
Argentina	360	400	250	264	**-9.8**
South Africa	110	166	130	145	**9.7**
United States	120	157	93	93	**-8.2**
Other world countries	114	75	102	82	**-10.4**
Total	1468	1526	1387	1466	**-0.1**
Grapefruit exports in selected countries					
South Africa	215	196	210	187	**-4.5**
United States	332	270	247	242	**-10**
Turkey	133	133	128	154	**5**
Israel	81	81	85	84	**1.2**
China	51	101	102	119	**32.6**
Other world countries	60	70	53	55	**-2.9**
Total	872	851	825	841	**-12**
Mandarins' group exports in selected countries					
China	371	486	740	712	**24.3**
Turkey	322	224	382	330	**0.8**
EU	247	269	258	267	**2.6**
Morocco	292	272	332	323	**3.4**
South Africa	106	112	102	113	**2.2**
Other world countries	171	189	202	229	**10**
Total	1509	1552	2016	1974	**9.4**

[1] Split year refers to the harvest and marketing period, which corresponds roughly to October-September in the Northern Hemisphere. For the Southern Hemisphere, harvest occurs entirely during the second year shown and the harvest and marketing period begins in the second year shown.

Source: Own table based on (USDA, 2012).

Appendix 29

World citrus fruit imports between 2006/07 and 2009/10 by country and product; Unit: 1000 M.T. and %

Oranges imports in selected countries					
	2006/07	**2007/08**	**2008/09**	**2009/10**	**AAGR in %**
EU	1042	1040	846	959	**-2.7**
Russia	500	517	436	478	**-1.5**
Saudi Arabia	270	300	302	280	**1.2**
Canada	170	214	177	204	**6.3**
United Arab Emirates	85	106	132	194	**31.7**
Other world countries	1050	1174	1143	1216	**5**
Total	3117	3351	3036	3331	**2.2**
Lemons and limes imports in selected countries					
United States	391	424	398	401	**0.9**
EU	418	515	405	471	**4.1**
Russia	205	191	203	211	**1**
Saudi Arabia	70	46	125	84	**6.3**
Canada	58	58	58	65	**3.9**
Other world countries	202	202	213	201	**-0.2**
Total	1344	1436	1402	1433	**2.2**
Grapefruit imports in selected countries					
EU	399	430	399	389	**-0.8**
Japan	221	188	180	168	**-8.7**
Russia	74	95	86	106	**12.7**
Canada	55	51	48	46	**-5.8**
Ukraine	15	19	16	21	**11.9**
Other world countries	65	57	60	62	**-1.6**
Total	829	840	789	792	**-1.5**
Mandarins' group imports in selected countries					
Russia	454	486	520	593	**9.3**
EU	370	355	377	417	**4.1**
Ukraine	120	146	113	144	**6.3**
Indonesia	81	104	168	160	**25.5**
Vietnam	75	134	256	202	**39.1**
Other world countries	391	372	398	392	**0.1**
Total	1491	1597	1832	1908	**8.6**

Source: Own table based on (USDA, 2012).

Appendix 30

World citrus fruit fresh domestic consumption between 2006/07 and 2009/10 by country and product; Unit: 1000 M.T. and %

Oranges fresh domestic consumption in selected countries					
	2006/07	**2007/08**	**2008/09**	**2009/10**	**AAGR in %**
China	4612	5143	5729	6220	**10.5**
EU	5060	5772	5869	5717	**4.2**
Brazil	4561	5018	5275	4814	**1.8**
Mexico	3537	3299	3188	3167	**-3.6**
United States	1015	1406	1264	1347	**9.9**
Other world countries	6942	6953	6798	7436	**2.3**
Total	25727	27591	28123	28701	**3.7**
Lemons and limes fresh domestic consumption in selected countries					
EU	1359	1404	1364	1395	**0.9**
Mexico	1180	1322	1192	1149	**-0.9**
United States	716	625	787	738	**1**
Turkey	376	424	296	290	**-8.3**
Russia	198	186	198	210	**2**
Other world countries	451	399	518	480	**2.1**
Total	4280	4360	4355	4262	**-0.1**
Grapefruit fresh domestic consumption in selected countries					
China	1977	2132	2424	2788	**12.1**
EU	438	495	435	449	**0.8**
United States	387	434	388	389	**0.2**
Mexico	230	321	332	293	**8.4**
Japan	221	188	180	168	**-8.7**
Other world countries	307	332	315	346	**4.1**
Total	3560	3902	4074	4433	**7.6**
Mandarins' group fresh domestic consumption in selected countries					
China	8006	9850	11371	12977	**17.5**
EU	2724	2753	2930	2812	**1.1**
Japan	851	1065	904	994	**5.3**
Russia	452	484	518	592	**9.4**
United States	356	426	440	529	**14.1**
Other world countries	2056	2274	2141	2424	**5.6**
Total	14445	16852	18304	20328	**12.1**

Source: Own table based on (USDA, 2012).

Appendix 31

Total production of citrus fruits in the EU during 2002-2009; Unit: M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Oranges	6204512	6059030	5868997	5842820	6925367	5997633	6913724	6303267	**0.23%**
Mandarins, clementine ...etc.	2868978	2776409	3287593	2820158	3434334	2810857	3237763	3154559	**1.36%**
Lemons and limes	1620762	1826934	1497053	1665308	1567939	1176231	1321379	1256333	**-3.57%**
Grapefruit (inc. Pomelos)	79001	76694	86474	84031	93665	87239	87605	87331	**1.44%**
Citrus fruit, nes	48944	39276	42852	45000	60419	31004	42441	43541	**-1.66%**
Total	**10822197**	**10778343**	**10782969**	**10457317**	**12081724**	**10102964**	**11602912**	**10845031**	**0.03%**

Source: Own table based on (FAOSTAT, 2011).

Appendix 32

Total EU intra and extra imports by products' value and products' quantity in 2002, 2006, and 2009

	2002				2006				2009			
	Quantity 1000 M.T.		Value million €		Quantity 1000 M.T.		Value million €		Quantity 1000 M.T.		Value million €	
	Intra	Extra	Intra	Extra	Intra	Extra	Intra	Extra	Intra	Extra	Intra	Extra
Oranges	2028	758	1093	340	1888	898	1064	412	1952	848	1173	453
Lemons and limes	591	299	363	172.8	602	403	372	235	647	420	476	289.6
Mandarin, clementines …etc.	1353	333	1015	229	1617	372	1106	248	1491	376	1302	268
Grapefruits (inc. Pomelos)	173	487	105	236	202	370	151	254	241	400	167	250
Citrus fruit, nes	15	2	12	4.2	14	2	13	3.6	27	2	18	3.4
Total	4160	1879	2588	982	4323	2045	2706	1153	4358	2046	3136	1264

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011).

Appendix 33

Total import volume of citrus fruits in the EU during 2002-2009; Unit: M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Oranges	2786080	2808717	3026430	2717874	2785341	2992271	2905324	2800063	**0.07%**
Mandarins, clementine ...etc.	1685749	1664876	1826388	1952117	1988833	2041610	1893596	1866794	**1.5%**
Lemons and limes	890106	823964	956314	1051605	1005711	1021288	1087870	1066314	**2.6%**
Grapefruit (inc. Pomelos)	659710	516929	546330	556363	571892	640179	676519	641248	**-0.4%**
Citrus fruit, nes	17118	14309	13893	13566	15889	21255	34052	29346	**8%**
Total	**6038763**	**5828794**	**6369354**	**6291524**	**6367666**	**6716603**	**6597360**	**6403764**	**0.84%**

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011).

Appendix 34

Imports of fresh citrus fruit by EU member countries during 2002-2009; Unit: in M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Austria	128726	131400	138524	145115	161746	146225	154252	159217	3.1
Belgium	383284	367205	352504	386647	312054	306514	322323	289525	-4
Bulgaria	45143	47385	46188	51859	57986	53938	46645	71932	6.9
Cyprus	0	100	740	1037	1848	2537	3085	2553	71.6
Czech Republic	138221	142122	161093	162519	164016	173731	153737	148123	1
Denmark	78493	77020	76513	71172	79961	102115	110084	118609	6.1
Estonia	11777	12599	13034	14054	14305	16242	15296	14834	3.4
Finland	68757	70557	67999	62295	67194	72856	66601	71472	0.6
France	1041552	1010594	1031850	951139	956613	1005109	965408	983476	-0.8
Germany	1193344	1220730	1260779	1165523	1158040	1145188	1137511	110934	-1
Greece	112961	33920	108529	82400	55342	83113	70372	70430	-6.5
Hungary	95431	105422	96992	61379	80985	54185	69999	60829	-6.2
Irland	43139	35597	37994	42392	49959	58900	61961	51615	2.6
Italy	300301	375109	374518	311388	305351	325742	312064	422858	5
Latvia	24144	23389	25335	28373	27942	33452	32159	31510	3.9
Lithuania	28257	30359	39435	44920	46996	56225	68235	74357	14.8
Luxembourg	7298	6984	7333	7008	7219	8172	8683	8450	2.1
Malta	8657	8461	9025	8193	7896	7553	6605	5821	-5.5
Netherlands	684871	774131	670536	813186	922039,1	1049803	1049770	989596	5.4
Poland	397023		389040	378011	387185	439404	428509	409443	0.4
Portugal	36907	38928	39539	45213	37850	74550	77113	71688	10
Romania	101193,4	108483	118020	141616	181093	167230	149100	124172	3

Slovakia	58233	565921	50978	62262	68624	76991	67598	57019	-0.3
Slovenia	34626	37594	44129	53269	55708	64205	62589	58394	7.8
Spain	157657	233119	227225	268107	189815	243844	271239	172620	1.3
Sweden	142191	143485	153827	136086	160356	177297	170164	154317	1.2
United Kingdom	716580	737511	827675	796362	809545	771481	716260	671562	-0.9
EU	6038763	5828794	6369354	6291524	6367666	6716603	6597360	6403764	0.8

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011).

Appendix 35

Total EU intra and extra exports by products' value and products' quantity in 2002, 2006, and 2009

	2002				2006				2009			
	Quantity 1000 M.T.		Value million €		Quantity 1000 M.T.		Value million €		Quantity 1000 M.T.		Value million €	
	Intra	Extra	Intra	Extra	Intra	Extra	Intra	Extra	Intra	Extra	Intra	Extra
Oranges	2147	238	1194	146	1868	218	1054	108	1949	243	1256	142
Lemons and limes	609	113	348	58,6	619	90,4	369	47,1	651	84,5	486	53
Mandarin, clementines …etc.	1470	160	1125	137	1678	232	1166	176	1661	257	1318	207
Grapefruits (inc. Pomelos)	211	9	127	6	224	10	163	8	257	21	171	15
Citrus fruit, nes	20	2	15	1,4	12	0,6	11	0,9	11	0,5	11	1
Total	4457	522	2809	349	4401	551	2763	340	4529	606	3242	418

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011).

Appendix 36

Total export volume of citrus fruits in the EU during 2002-2009; Unit: M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Oranges	2384617	2309435	2252933	1866271	2085186	2180885	2107868	2192292	**-1.2%**
Mandarins, clementine ...etc.	1629365	1731772	1708073	1917808	1910336	2091775	1866289	1918491	**2.4%**
Lemons and limes	723422	706152	744285	631479	710549	681245	631575	734466	**0.2%**
Grapefruit (inc. Pomelos)	219846	224110	217432	238690	234519	273668	290991	278389	**3.4%**
Citrus fruit, nes	22175	11808	7700	11117	12178	13797	10809	11653	**-8.8%**
Total	**4979425**	**4983276**	**4930421**	**4665366**	**4952767**	**5241370**	**4907533**	**5135289**	**0.4%**

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011).

Appendix 37

Exports of fresh citrus fruit by EU member countries during 2002-2009; Unit: in M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Austria	2608.8	24227	27679	40923	48099	37987	46710	54708	11.2
Belgium	180032	153538	164867	194630	116330	102232	130521	112518	-6.5
Bulgaria	86	228	46	68	57	1014	4177	9641	96
Cyprus	73001	71918	97543	70494	63683	56075	51088	41443	-7.8
Czech Republic	2454	2524	7465	23397	25704	22332	21565	22710	37
Denmark	1459	1334	2338	2339	2517	3146	2697	3909	15
Estonia	41	30	21	292	132	38	90	379	37.4
Finland	124	269	327	90	132	290	54	74	-7.2
France	99750	99001	92577	92849	76563	78453	79535	83369	-2.5
Germany	62274	59946	67687	69661	78865	70421	90812	79008	3.5
Greece	321735	347936	243869	268359	271214	247188	253300	327600	0.3
Hungary	218	217	279	642	3425	7382	3951	4978	56.3
Irland	1321	705	768	4078	3667	3760	3679	3430	14.6
Italy	218289	151130	171768	214565	216085	235251	255514	220751	0.2
Latvia	40	160	347	1401	1029	1983	3244	4612	96.8
Lithuania	1420	1830	7703	11880	11630	22241	31255	40066	61.2
Luxembourg	119	105	143	421	315	197	192	234	10.1
Malta	0	26			25		22	24	
Netherlands	430905	485592	451029	484282	450776	519169	558979	543901	3.4
Poland	6704		12638	16027	23839	37950	41490	38636	28.4
Portugal	1588	1500	3363	14289	24183	27903	32767	29720	52
Romania	13	106	169	210	230	408	993	1196	90.8

Slovakia	727	662	1204,5	8252	18234	9205	8382	7181	38.7
Slovenia	77	387	4806,9	16849	23111	45299	47302	37724	142
Spain	3523572	3543641	3527463	3082244	3427196	3683304	3212239	343022	-0.4
Sweden	4583	4304	5271	2306,2	5673	4307	2835	1437	-15.3
United Kingdom	22806	31961	39048	44818	60055	23837	24139	35825	6.7
EU	4979425	4983276	4930421	4665365,5	4952767	5241370	4907533	5135289	0.4

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011).

Appendix 38

Total gross supply (consumption) volume of citrus fruits in the EU during 2002-2009; Unit: M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Oranges	6605975	6558313	6642494	6694423	7625522	6809019	7711179	6911038	**0.7%**
Mandarins, clementine ...etc.	2925362	2709513	3405908	2854467	3512831	2760692	3265070	3102862	**0.9%**
Lemons and limes	1787447	1944746	1709083	2085433	1863101	1516274	1777674	1588181	**-1.7%**
Grapefruit (inc. Pomelos)	518864	369513	415372	401704	431038	453749	473132	450190	**-2%**
Citrus fruit, nes	43887	41777	49046	47448	64131	38462	65684	61234	**4.9%**
Total	**11881535**	**11623861**	**12221902**	**12083476**	**13496624**	**11578196**	**13292739**	**12113506**	**0.3%**

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011)

Appendix 39

Consumption of fresh citrus fruit by EU member countries during 2002-2009; Unit: in M.T.

	2002	2003	2004	2005	2006	2007	2008	2009	AAGR in %
Austria	102639	107173	110844	104192	113647	108238	107542	104508	0.3
Belgium	203252	213667	187637	192017	195724	204281	191802	177007	-2
Bulgaria	45058	47157	46142	51792	57929	52924	42468	62291	4.7
Cyprus	65149	54524	50459	73137	75391	69794	64200	77890	2.6
Czech Republic	135767	139598	153628	139122	138312	151399	132172	125413	-1.1
Denmark	77034	75686	74175	68833	77444	98970	107387	114701	5.9
Estonia	11736	12569	13013	13762	14173	16205	15206	14455	3
Finland	68632	70288	67672	62205	67062	72566	66547	71398	0.6
France	972194	936951	968410	883333	912077	948550	914259	934807	-0.6
Germany	1131070	1160783	1193092	1095862	1079175	1074767	1046699	1030334	-1.3
Greece	1291292	897484	731087	968295	887653	864773	832672	756430	-7.4
Hungary	95212	105205	96713	60737	77560	46804	66048	55851	-7.3
Irland	41818	34892	37226	38314	46292	55141	58282	48185	2.1
Italy	2871228	3005141	3538336	3614919	3743034	3458373	3922322	4119007	5.3
Latvia	24103	23230	24988	26972	26913	31469	28915	26897	1.6
Lithuania	26837	28529	31732	33040	35366	33983	36981	34291	3.6
Luxembourg	7178	6880	7190	6586	6904	7974	8491	8216	2
Malta	11939	11543	11420	11191	10583	10449	9969	8596	-4.6
Netherlands	253966	288539	219507	328904	471264	530634	490790	445695	8.4
Poland	390320	0	376402	361984	363346	401454	387019	370808	-0.7
Portugal	382462	390520	361336	321292	320555	316308	299270	322079	-2.4
Romania	101180	108377	117851	141406	180864	166822	148107	122976	2.8

Slovakia	57506	55929	49774	54010	50389	67787	59216	49838	**-2**
Slovenia	34549	37207	39322	36420	32597	18907	15286	20670	**-7.1**
Spain	2648032	2967260	2776763	2509827	3608196	1848992	3381641	2222545	**-2.5**
Sweden	137608	139181	148557	133780	154684	172990	167329	152880	**1.5**
United Kingdom	693774	705550	788627	751544	749490	747644	692121	635737	**-1.2**
EU	11881535	11623861	12221902	12083476	13496624	11578196	13292739	12113506	**0.3**

Source: Own table based on (FAOSTAT, 2011; Eurostat. 2011

Appendix 40

FUNDACIÓN ANGEL REY / freshfel EUROPE	**MARKETING STANDARDS** **ORANGES (*Citrus sinensis* L.)**	

PRODUCT: **ORANGES (*Citrus sinensis* (L.) Osb.)**
VARIETIES: Several

FILE NUMBER: **27**
VERSION: **2**
SOURCE: **EU**

0. REFERENCE	Regulation 1799/2001 of 12 September 2001. Amended by: Reg. 453/2002 of 13 March 2002; Reg. 2010/2002 of 12 November 2002; Reg. 46/2003 of 10 January 2003; Reg. 2173/2003 of 12 December 2003, Reg. 907/2004 of 29 April 2004.
1. DEFINITION	This standard applies to oranges for supply fresh to the consumer. Oranges for industrial use are excluded.

2. MINIMUM REQUIREMENTS

Intact, free from bruising and/or extensive healed over cuts, sound, clean, practically free from pests and their damages, free of sign of internal shrivelling, free from damage due to low temperature or frost, free of abnormal external moisture, free of any foreign smell and/or taste.

3. DEVELOPMENT AND MATURITY REQUIREMENTS

Carefully picked and having reached an appropriate degree of development and ripeness. Development and condition must be such as to enable the oranges to withstand transport and handling, and to arrive in satisfactory condition at destination.
'Degreening' treatment of fruit meeting the ripeness requirement is permitted only if the other organoleptic characteristics are not modified.

Maturity requirements

1. Colouring: typical of the variety. Light green colour fruits are allowed provided ≤ 1/5 of the total surface.
2. Minimum juice content depending on varieties:
   - Blood oranges: 30%; - Navels group: 33%; - Others: 35%;

• Green colour fruits (> 1/5 of the total surface) produced in areas with high air temperatures and high relative humidity conditions are allowed if they satisfy the following min. juice content:
- varieties Mosambi, Sathudi and Pacitan: 33%; - other varieties: 45%

4. CLASSIFICATION

'Extra' Class: Superior quality. Characteristic of the variety and/or commercial type in shape, external appearance, development and colouring. Only slight superficial defects allowed, provided these do not affect appearance, quality, postharvest life or presentation.
Tolerance: 5% by number or weight out of standards, but within Class I standards or, exceptionally, coming within the tolerances of that class.

Class I: Good quality. Characteristic of the variety and/or commercial type.
Defects admitted, if they do not affect appearance, quality, postharvest life or presentation:
- slight defects in shape and/or colouring,
- slight skin defects occurring during the formation of the fruit (e.g. silver scurfs, russets),
- slight healed defects due to a mechanical cause(e.g. hail damage, rubbing , damage from handling).

Tolerance: 10% by number or weight out of standards, but within Class II standards or, exceptionally, coming within the tolerances of that class.

Class II: Defects admitted, provided they retain their essential characteristics of quality and presentation:
- defects in shape and/or colouring,
- rough skin,
- skin defects occurring during the formation of the fruit (e.g. silver scurfs, russets)
- healed defects due to a mechanical cause (e.g. hail damage, rubbing, damage from handling)
- superficial healed skin alterations,
- slight and partial detachment of the pericarp.

Tolerance: 10% by number or weight out of standards, with the exception of produce affected by deterioration affecting consumption (e.g. rotting). Within this tolerance, a maximum 5% is allowed of fruit showing slight superficial unhealed damage, dry cuts or soft and shrivelled fruit.

5. SIZING
By diameter or by count

By diameter: (maximum diameter of the equatorial section of the fruit).

Minimum size: 53 mm

Scale	Size Code	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	Diameter (mm)	92-110	87-100	84-96	81-92	77-88	73-84	70-80	67-76	64-73	62-70	60-68	58-66	56-63	53-60

By count:
Size range in the package may fall outside a single size code, but within two adjacent codes

Uniformity:

Fruit arrangement	Difference between the smallest and largest fruit in the same package (or lot)
in regular layers (in packages or in unit consumer packages)	- size codes 0 – 2: ≤ 11 mm - size codes 3 – 6: ≤ 9 mm - size codes 7 – 13: ≤ 7 mm
not in regular layers (in packages or in rigid unit consumer packages)	- packed by diameter: ≤ the range of the appropriate size grade - packed by count: ≤ the range of one of the two adjacent codes concerned
in bulk bins or in non-rigid unit consumer packages	≤ the range obtained by grouping three consecutive sizes in the size scale.

Size tolerance: 10 % by number or weight of fruits out of specifications but corresponding to the size immediately below or above. This tolerance only applies to fruit ≥ 50 mm.

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MARKETING STANDARDS

ORANGES (*Citrus sinensis* L.)

6. PRESENTATION

Uniformity: in origin, variety or commercial type, quality and size and appreciably the same degree of ripeness and development. 'Extra' class produce requires uniformity in colouring. The visible part must be representative of the entire contents.

Packaging: The produce must be packed in such a way to assure its protection.
Materials must be new, clean and of a proper quality. Non-toxic ink or glue.
Wrapping paper: thin, dry, new, and odourless (the use of chemical substances liable to leave a foreign smell on the skin of the fruit is permitted where it is compatible with regulations).
Packages must be free of all foreign matter. A short (not wooden) twig with some green leaves adhere to the fruit is allowed.
Stickers individually affixed to products shall be removable without leaving a visible trace of glue or damaging the fruit skin.

Presentation:
(a) arranged in regular layers in packages,
(b) not arranged in regular layer in packages or in bins (only classes I and II),
(c) in individual packages for direct sale to the consumer (<5 Kg) made up by number of fruits or by net weight of the package.

Mixed products: Oranges can be mixed, in sales packages of < 3 Kg net weight, with different types of fresh fruit and vegetables on the condition laid down by the Regulation 48/2003 of 10 January 2003.

7. MARKING

-legibly and indelibly marked,
- grouped on the same side,
-visible from the outside.

Identification: The name and address of the packer and/or dispatcher, which can be replaced on:
packages but not pre-packages by a code mark (officially issued or accepted) of the packer and/or dispatcher. The latter should be accompanied by the words "packer and/or dispatcher" (or equivalent abbreviations); or
pre-packages only by the name and address of a seller in the EU in close connection with the words "Packed for:" and a code to represent the packer and/or distributor (coded information must be available on request).
Packages containing sales packages visible from the outside, marked with the above markings, must be free of markings. Where palletised, the pallet should be labelled with the above information on two sides.

Nature of the produce:
-'Orange', if not visible from the outside,
- name of the variety.

Origin: Country (comp) and district or local name (opt)

Commercial specifications:
- class,
- size:
  - size code for fruit presented in accordance with the size scale,
  - upper and lower limit size code in the case of three consecutive sizes of the size scale,
  - for fruit arranged in layers in the package:
    - size code and number of fruits,
    - size codes or min. and max. diameter, and number of fruits (packed by count fall under two adjacent codes),

-mention of the preserving agent or other chemical substance used at post-harvest stage, when used.

Official control mark: (opt)

8. CONTAMINANTS

Heavy metals	Maximum level	Commission Regulation	Sampling & Analysis methods
Lead (Pb)	0,1 mg/kg wet weight	466/2001	Directive 2001/22/EC
Cadmium (Cd)	0,05 mg/kg wet weight	466/2001	Directive 2001/22/EC

MARKETING STANDARDS
MANDARINS (*Citrus spp.)*

PRODUCT: **MANDARINS** (*Citrus reticulata* **Blanco), SATSUMAS (*C. unshiu* Marcow), CLEMENTINES (*C. clementina* Hort. Ex Tan.), Common MANDARINS (*C. delicosa* Ten.), TANGERINES (*C. tangerina* Hort. Ex Tan.), and hybrids.**

VARIETIES: Several

FILE NUMBER: **24**
VERSION: **2**
SOURCE: **EU**

0. REFERENCE	Regulation 1799/2001 of 12 September 2001 Amended by: Reg. 453/2002 of 13 March 2002; Reg. 2010/2002 of 12 November 2002; Reg. 46/2003 of 10 January 2003; Reg. 2173/2003 of 12 December 2003, Reg. 907/2004 of 29 April 2004..
1. DEFINITION	This standard applies to mandarins for supply fresh to the consumer. Mandarins for industrial use are excluded.

2. MINIMUM REQUIREMENTS

Intact, free from bruising and/or extensive healed over cuts, sound, clean, practically free from pests and their damages, free of sign of internal shrivelling, free from damage due to low temperature or frost, free of abnormal external moisture, free of any foreign smell and/or taste.

3. DEVELOPMENT AND MATURITY REQUIREMENTS

Carefully picked and having reached an appropriate degree of development and ripeness. Development and condition must be such as to enable the mandarins to withstand transport and handling, and to arrive in satisfactory condition at destination.

'Degreening' treatment of fruit meeting the ripeness requirement is permitted only if the other organoleptic characteristics are not modified.

Maturity requirements

1. Minimum juice content depending on varieties:
   - Mandarins, excluding Clementines: 33%
   - Clementines: 40%
2. Colouring: typical of the variety on ≥ 1/ 3 of the surface.

4. CLASSIFICATION

'Extra' Class: Superior quality. Characteristic of the variety and/or commercial type in shape, external appearance, development and colouring. Only slight superficial defects allowed, provided these do not affect appearance, quality, postharvest life or presentation.

Tolerance: 5% by number or weight out of standards, but within Class I standards or, exceptionally, coming within the tolerances of that class.

Class I: Good quality. Characteristic of the variety and/or commercial type.
Defects admitted, if they do not affect appearance, quality or postharvest life:
- slight defects in shape and/or colouring,
- slight skin defects occurring during the formation of the fruit (e.g. silver scurfs, russets),
- slight healed defects due to a mechanical (e.g. hail damage, rubbing, damage from handling)

Tolerance: 10% by number or weight out of standards, but within Class II standards or, exceptionally, coming within the tolerances of that class.

Class II: Defects admitted, provided they retain their essential characteristics of quality and presentation:
- defects in shape and/or colouring,
- rough skin,
- skin defects occurring during the formation of the fruit (e.g. silver scurfs, russets)
- healed defects due to a mechanical (e.g. hail damage, rubbing, damage from handling)
- superficial healed skin alterations,
- detachment of the pericarp.

Tolerance: 10% by number or weight out of standards, with the exception of produce affected by deterioration affecting consumption (e.g. rotting). Within this tolerance, a maximum 5% is allowed of fruit showing slight superficial unhealed damage, dry cuts or soft or shrivelled fruit.

5. SIZING
By diameter or by count

By diameter: (max. diameter of the equatorial section of the fruit)

Minimum size: • Mandarins (excluding clementines): 45 mm ; • Clementines: 35 mm

Scale									
Size Code	1-XXX	1-XX	1 or 1-X	2	3	4	5	6	7
Diameter (mm)	≥ 78	67 – 78	63 – 74	58 – 69	54 – 64	50 – 60	46 – 56	43 – 52	41– 48

By count:

Size range in the package may fall outside a single size code, but within two adjacent codes.

Uniformity:

Fruit arrangement	Difference between the smallest and largest fruit in the same package (or lot)
in regular layers (in packages or in unit consumer packages)	- size codes 1 – XXX- 4: ≤ 9 mm - size codes 5 – 6: ≤ 8 mm - size codes 7 – 10: ≤ 7 mm
not in regular layers (in packages or in rigid unit consumer packages)	- packed by diameter: ≤ the range of the appropriate size grade - packed by count: ≤ the range of one of the two adjacent codes concerned
in bulk bins or in non-rigid unit consumer packages	≤ the range obtained by grouping three consecutive sizes in the size scale.

Size tolerance: 10 % by number or weight of fruits out of specifications but corresponding to the size immediately below or above. This tolerance applies only to mandarins (excluding clementins) ≥ 43 mm and clementins ≥ 34 mm.

MARKETING STANDARDS

MANDARINS (*Citrus spp.)*

<table>
<tr><td rowspan="4">6. PRESENTATION</td><td colspan="2">Uniformity: in origin, variety or commercial type, quality, size and appreciably the same degree of ripeness and development. 'Extra' class produce requires uniformity in colouring. The visible part must be representative of the entire contents.</td></tr>
<tr><td colspan="2">Packaging: The produce must be packed in such a way to assure its protection.
Materials must be new, clean and of a proper quality. Non-toxic ink or glue.
Wrapping paper: thin, dry, new, and odourless (the use of chemical substances liable to leave a foreign smell on the skin of the fruit is permitted where it is compatible with regulations).
Packages must be free of all foreign matter. A short (not wooden) twig with some green leaves adhere to the fruit is allowed.
Stickers individually affixed to products shall be removable without leaving a visible trace of glue or damaging the fruit skin.</td></tr>
<tr><td colspan="2">Presentation:
(a) arranged in regular layers in packages,
(b) not arranged in regular layer in packages or in bins (only classes I and II),
(c) in individual packages for direct sale to the consumer (<5 Kg) made up by number of fruits or by net weight of the package.</td></tr>
<tr><td colspan="2">Mixed products: Mandarins may be mixed, in sales packages of < 3 Kg net weight, with different types of fresh fruit and vegetables on the condition laid down by the Regulation 48/2003 of 10 January 2003.</td></tr>
<tr><td rowspan="3">7.
MARKING
-legibly and indelibly marked,
- grouped on the same side
-visible from the outside</td><td colspan="2">Identification: The name and address of the packer and/or dispatcher, which can be replaced on:
packages but not pre-packages by a code mark (officially issued or accepted) of the packer and/or dispatcher. The latter should be accompanied by the words "packer and/or dispatcher" (or equivalent abbreviations); or
pre-packages only by the name and address of a seller in the EU in close connection with the words "Packed for:" and a code to represent the packer and/or distributor (coded information must be available on request).
Packages containing sales packages visible from the outside, marked with the above markings, must be free of markings. Where palletised, the pallet should be labelled with the above information on two sides.</td></tr>
<tr><td>Nature of the produce:
-name of the species or variety,
-for clementines name of the type: 'Clementines, pipless', 'Clementines,' and 'Clementines with pips' (> 10 pips), where appropriate.</td><td>Origin: Country (comp) and district or local name (opt)</td></tr>
<tr><td>Commercial specifications:
- class,
- size:
- size code for fruit presented in accordance with the size scale,
- upper and lower limit size code in the case of three consecutive sizes of the size scale,
- for fruit arranged in layers in the package:
- size code and number of fruits,
- size codes or min. and max. diameter, and number of fruits (packed by count fall under two adjacent codes),
-mention of the preserving agent or other chemical substance used at post-harvest stage, when used.</td><td>Official control mark:
(opt)</td></tr>
</table>

8.CONTAMINANTS

Heavy metals	Maximum level	Commission Regulation	Sampling & Analysis methods
Lead (Pb)	0,1 mg/kg wet weight	466/2001	Directive 201/22/EC
Cadmium (Cd)	0,05 mg/kg wet weight	466/2001	Directive 201/22/EC

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MARKETING STANDARDS

LEMONS (*Citrus limon* L.)

PRODUCT: **LEMONS (*Citrus limon* (L.) Burm. f.)**

VARIETIES: Several

FILE NUMBER: **22**
VERSION: **2**
SOURCE: **EU**

0. REFERENCE: Regulation 1799/2001 of 12 September 2001.
Amended by: Reg. 453/2002 of 13 March 2002; Reg. 2010/2002 of 12 November 2002; Reg. 46/2003 of 10 January 2003; Reg. 1799/2001 of 12 December 2003, Reg. 907/2004 of 29 April 2004..

1. DEFINITION: This standard applies to lemons for supply fresh to the consumer. Lemons for industrial use are excluded.

2. MINIMUM REQUIREMENTS

Intact, free from bruising and/or extensive healed over cuts, sound, clean, practically free from pests and their damages, free of sign of internal shrivelling, free from damage due to low temperature or frost, free of abnormal external moisture, free of any foreign smell and/or taste.

3. DEVELOPMENT AND MATURITY REQUIREMENTS

Carefully picked and having reached an appropriate degree of development and ripeness. Development and condition must be such as to enable them to withstand transport and handling, and to arrive in satisfactory condition at destination.
'Degreening' treatment of fruit meeting the ripeness requirement is permitted only if the other organoleptic characteristics are not modified.

Maturity requirements

1. Minimum juice content depending on varieties:
   - Verdelli and Pimifiore lemons: 20%
   - Other lemons: 25 %
2. Colouring: typical of the variety. Green (but not dark green) colour is allowed provided minimum juice content is satisfied.

4. CLASSIFICATION

'Extra' Class: Superior quality. Characteristic of the variety and/or commercial type in shape, external appearance, development and colouring. Only slight superficial defects allowed, provided these do not affect appearance, quality, postharvest life or presentation.
Tolerance: 5% by number or weight out of standards, but within Class I standards or, exceptionally, coming within the tolerances of that class.

Class I: Good quality. Characteristic of the variety and/or commercial type.
Defects admitted, if they do not affect appearance, quality, postharvest life or presentation:
- slight defects in shape and/or colouring,
- slight skin defects occurring during the formation of the fruit (e.g. silver scurfs, russets),
- slight healed defects due to a mechanical cause (e.g. hail damage, rubbing, damage from handling).

Tolerance: 10% by number or weight out of standards, but within Class II standards or, exceptionally, coming within the tolerances of that class.

Class II: Defects admitted, provided they retain their essential characteristics of quality, the keeping quality and presentation:
- defects in shape and/or colouring,
- rough skin,
- skin defects occurring during the formation of the fruit (e.g. silver scurfs, russets),
- healed defects due to a mechanical cause(e.g. hail damage, rubbing, damage from handling),
- superficial healed skin alterations.

Tolerance: 10% by number or weight out of standards, with the exception of produce affected by deterioration affecting consumption (e.g. rotting). Within this tolerance, a maximum 5% is allowed of fruit showing slight superficial unhealed damage, dry cuts or soft and shrivelled fruit.

5. SIZING By diameter or by count

By diameter: (max. diameter of the equatorial section of the fruit).

Minimum size: 45 mm

Scale								
Size Code	0	1	2	3	4	5	6	7
Diameter (mm)	79 – 90	72 – 83	68 – 78	63 – 72	58 – 67	53 – 62	48 – 57	45 – 52

By count:

Size range in the package may fall outside a single size code, but within two adjacent codes.

Uniformity:

Fruit arrangement	Difference between the smallest and largest fruit in the same package (or lot)
in regular layers (in packages or in unit consumer packages)	≤ 7 mm
not in regular layers (in packages or in rigid unit consumer packages)	- packed by diameter: ≤ the range of the appropriate size grade - packed by count: ≤ the range of one of the two adjacent codes concerned
in bulk bins or in non-rigid unit consumer packages	≤ the range obtained by grouping three consecutive sizes in the size scale.

Size tolerance: 10 % by number or weight of fruits out of specifications but corresponding to the size immediately below or above. This tolerance applies only to fruit ≥ 43 mm.

MARKETING STANDARDS

LEMONS (*Citrus limon* L.)

<table>
<tr><td rowspan="4">6. PRESENTATION</td><td colspan="2">Uniformity: in origin, variety or commercial type, quality, size and appreciably the same degree of ripeness and development.
'Extra' class produce requires uniformity in colouring.
The visible part must be representative of the entire contents.</td></tr>
<tr><td colspan="2">Packaging: The produce must be packed in such a way to assure its protection.
Materials must be new, clean and of a proper quality. Non-toxic ink or glue.
Wrapping paper: thin, dry, new, and odourless (the use of chemical substances liable to leave a foreign smell on the skin of the fruit is permitted where it is compatible with regulations).
Packages must be free of all foreign matter. A short (not wooden) twig with some green leaves adhere to the fruit is allowed.
Stickers individually affixed to products shall be removable without leaving a visible trace of glue or damaging the fruit skin.</td></tr>
<tr><td colspan="2">Presentation:
(a) arranged in regular layers in packages,
(b) not arranged in regular layer in packages or in bins (Only Classes I and II),
(c) in individual packages for direct sale to the consumer (<5 Kg) made up by number of fruits or by net weight of the package.</td></tr>
<tr><td colspan="2">Mixed products: Lemons may be mixed, in sales packages of < 3 Kg net weight, with different types of fresh fruit and vegetables on the condition laid down by the Regulation 48/2003 of 10 January 2003.</td></tr>
<tr><td rowspan="3">7.
MARKING
-legibly and indelibly marked,
- grouped on the same side,
-visible from the outside.</td><td colspan="2">Identification: The name and address of the packer and/or dispatcher, which can be replaced on:
packages but not pre-packages by a code mark (officially issued or accepted) of the packer and/or dispatcher. The latter should be accompanied by the words "packer and/or dispatcher" (or equivalent abbreviations); or
pre-packages only by the name and address of a seller in the EU in close connection with the words "Packed for:" and a code to represent the packer and/or distributor (coded information must be available on request).
Packages containing sales packages visible from the outside, marked with the above markings, must be free of markings. Where palletised, the pallet should be labelled with the above information on two sides.</td></tr>
<tr><td>Nature of the produce:
-'Lemons', if not visible from the outside,
- name of the type: 'Verdelli' and 'Primofiore', where appropriate.</td><td>Origin: Country (comp) and district or local name (opt)</td></tr>
<tr><td>Commercial specifications:
-class,
- size:
- size code for fruit presented in accordance with the size scale,
- upper and lower limit size code in the case of three consecutive sizes of the size scale,
- for fruit arranged in layers in the package:
- size code and number of fruits,
- size codes or min. and max. diameter, and number of fruits (packed by count fall under two adjacent codes),
-mention of the preserving agent or other chemical substance used at post-harvest stage, when used.</td><td>Official control mark:
(opt)</td></tr>
</table>

8. CONTAMINANTS

Heavy metals	Maximum level	Commission Regulation	Sampling & Analysis methods
Lead (Pb)	0,1 mg/kg wet weight	466/2001	Directive 2001/22/EC
Cadmium (Cd)	0,05 mg/kg wet weight	466/2001	Directive 2001/22/EC

MARKETING STANDARDS

LIMES (*Citrus latifolia*)

PRODUCT: **LIMES (*Citrus latifolia* Tanaka[(*)])**

[(*)] Depending upon the country, also called: **Bearss, Persian, Tahiti.**

VARIETIES: Several

FILE NUMBER: **9**
VERSION: **1**
SOURCE: **CA**

0. REFERENCE	Codex standard 213-1999. Amended in 2001.
1. DEFINITION	This standard applies to limes for supply fresh to the consumer. Limes for industrial use are excluded.

2. MINIMUM REQUIREMENTS

Whole, firm, sound, clean, fresh in appearance, practically free of bruising, practically free from pests and their damages, free of damage caused by low temperature, free of abnormal external moisture, free of any foreign smell and/or taste, pipless.

- **Minimum Juice Content:** 42% (calculated in relation to the total weight of the fruit).
- **Colouring:** typical of the variety on $\geq 2/3$ of the surface. Green but may show discolouring (yellow patches) $\leq 30\%$ of its surface.

3. DEVELOPMENT AND CONDITION

Carefully picked limes, which have reached an appropriate degree of development and ripeness (according to variety and growing area). Development and condition must be such as to enable them to withstand transport and handling, and to arrive in satisfactory condition at destination.

4. CLASSIFICATION

'Extra' Class: Superior quality. Characteristic of the variety. Clean and well shaped. Only very slight superficial defects allowed, provided these do not affect appearance, quality, postharvest life or presentation.

Tolerance: 5% by number or weight out of standards, but within Class I standards or, exceptionally, coming within the tolerances of that class.

Class I: Good quality. Characteristic of the variety. Defects admitted, if they do not affect appearance, quality, postharvest life or presentation; and, in no case, affect the pulp of the fruit:
- slight defects in shape and/or colouring,
- slight skin defects ($\leq 1{,}0$ cm^2).

Tolerance: 10% by number or weight out of standards, but within Class II standards or, exceptionally, coming within the tolerances of that class.

Class II: Defects admitted, provided they retain their essential characteristics of quality and presentation; and, in no case, affect the pulp:
- defects in shape and/or colouring ,
- slight skin defects ($\leq 2{,}0$ cm^2).

Tolerance: 10% by number or weight out of standards, with the exception of produce affected by deterioration affecting consumption (e.g. rotting).

5. SIZING By diameter

By diameter: (maximum diameter of the equatorial section)

To be developed.

Size tolerance: 10% by number or weight of limes out of specifications, but within the size immediately above and/or below. In no case the diameter can be < 40 mm.

6. PRESENTATION

Uniformity: in origin, variety, quality and size. For 'Extra' Class, also uniformity in colour.
The visible part must be representative of the entire contents.

Packaging: The produce must be packed in such a way to assure its protection.
Materials must be new, clean and of a proper quality. Non-toxic ink or glue.
Limes shall be packed in each container in compliance with the Recommended International Code of Practice for Packaging and Transport of Tropical Fresh Fruit and Vegetables (CAC/RCP 44-1995).
Containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the limes. Packages must be free of all foreign matter and smell.

7. MARKING

Consumer packages:

In addition to the requirements of the Codex General Standard for the Labelling of Pre-packaged Foods (Codex Stan 1-1985):
Nature of the produce: if not visible from the outside, name of produce and optionally name of variety.

Non-retail containers:

Information: legible and indelibly marked, grouped on same side, visible from the outside, or in documents accompanying the shipment.

Identification: name and address of exporter, packer and/or dispatcher. Identification code (opt).

Nature of the produce: - name of the produce, if not visible from the outside, - name of variety (opt).	**Origin:** Country (comp) and district or local name (opt)
Commercial specifications: Class; Size (code o minimum - maximum diameter); Net weight (opt).	**Official control mark:** (opt)

8. CONTAMINANTS

Heavy metals	Limes shall comply with those maximum levels for heavy metals established by CAC for this commodity.
Pesticide residues	Limes shall comply with those MRLs established by CAC for this commodity.

9. HYGIENE

Preparation and handling: in accordance with the appropriate section of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

Microbiological criteria: the produce shall comply with any microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 21-1997).

FUNDACIÓN ANGEL REY / freshfel EUROPE	**MARKETING STANDARDS** **GRAPEFRUITS** **(*Citrus paradisi* Macfad.)**	

PRODUCT: **GRAPEFRUITS (*Citrus paradisi* Macfad.)** VARIETIES: Several	FILE NUMBER: 7 VERSION: **1** SOURCE: **CA**

0. REFERENCE Codex standard 219-1999

1. DEFINITION This standard applies to grapefruits for supply fresh to the consumer. Grapefruits for industrial use are excluded.

2. MINIMUM REQUIREMENTS

Whole, firm, sound, clean, practically free of bruising, practically free from pests and their damages, free of damage caused by low and/or high temperature or frost, free of abnormal external moisture, free of any foreign smell and/or taste.

- **Minimum Juice Content:** 35% (calculated in relation to total weight of the fruit).
- **Colouring:** Typical of the variety. Greenish colour is allowed, provided minimum requirements compilation. Red-pulp varieties may have reddish patches on the rind. "Degreening" treatment permitted if it does not modify other organoleptic characteristics.

3. DEVELOPMENT AND CONDITION

Carefully picked grapefruits, which have reached an appropriate degree of development and ripeness (according to variety and/or commercial type, and growing area). Development and condition must be such as to enable them to withstand transport and handling, and to arrive in satisfactory condition at destination.

4. CLASSIFICATION

'Extra' Class: Superior quality. Characteristic of the variety and/or commercial type. Only very slight superficial defects allowed, provided these do not affect appearance, quality, postharvest life or presentation.

Tolerance: 5% by number or weight out of standards, but within Class I standards or, exceptionally, coming within the tolerances of that class.

Class I: Good quality. Characteristic of the variety and/or commercial type. Defects admitted, if they do not affect appearance, quality, postharvest life or presentation; and, in no case, affect the pulp of the fruit:
- slight defects in shape and/or colouring,
- slight skin defect inherent in the formation of the fruit,
- slight healed skin defects due to mechanical causes,
- slight skin discolouration due to rust mite, melanoses, and other blemishes ≤ 1/ 5 of the fruit surface.

Tolerance: 10% by number or weight out of standards, but within Class II standards or, exceptionally, coming within the tolerances of that class.

Class II: Defects admitted, provided they retain their essential characteristics of quality and presentation, and, in no case, affect the pulp:
- defects in shape and/or colouring,
- healed skin defects due to mechanical causes,
- slight skin discolouration due to rust mite, melanoses, and other blemishes ≤ 2/ 5 of the fruit surface,
- rough skin.

Tolerance: 10% by number or weight out of standards, with the exception of produce affected by deterioration affecting consumption (e.g. rotting). Within this tolerance, 5% by number or weight may show slight superficial unhealed damage, dry cuts or soft and shrivelled fruit.

5. SIZING

To be developed

Size tolerance: 10% by number or weight of grapefruits out of specifications. For bulk consignment, this tolerance only applies to fruit with a diameter ≥ 70 mm.

6. PRESENTATION

Uniformity: in origin, variety and/or commercial type, quality, size and colour.
The visible part must be representative of the entire contents.

Packaging: The produce must be packed in such a way to assure its protection.
Materials must be new, clean and of a proper quality. Non-toxic ink or glue.
Grapefruits shall be packed in each container in compliance with the Recommended International Code of Practice for Packaging and Transport of Tropical Fresh Fruit and Vegetables (CAC/RCP 44-1995).
Containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the grapefruits. Packages must be free of all foreign matter and smell.

Presentation:
(a) aligned in regular layers, according to size ranges, in closed or open packaging.
Mandatory for 'Extra' Class and optional for Classes I and II.
(b) non-aligned in closed or open packaging according to size ranges. Only allowed for Classes I & II.
(c) in bulk, by one means of transport or in one transport compartment, without further requirement than minimum size. Only allowed for Class II.
(d) individual consumer packages of ≤ 5 kg., made up:
- by number of fruits (mandatory size scale for all classes), or,
- by weight (no compulsory size scale but, maximum difference between grapefruits ≤ sum of 3 consecutive sizes in size scale).

7. MARKING

Consumer packages:
In addition to the requirements of the Codex General Standard for the Labelling of Pre-packaged Foods (Codex Stan 1-1985):
Nature of the produce: if not visible from the outside, name of produce and optionally name of variety and/or commercial type.

Non-retail containers:
Information: legible and indelibly marked, grouped on the same side, visible from outside, or in documents accompanying the shipment. For produce transported in bulk, these particulars appear on a document going with the goods.

Identification: name and address of exporter, packer and/or dispatcher. Identification code (opt).

	MARKETING STANDARDS **GRAPEFRUITS** **(*Citrus paradisi* Macfad.)**	

	Nature of the produce: - name of the produce, if not visible from the outside, - name of variety and/or commercial type, - "pink" or "red", where appropriate.	**Origin:** Country (comp) and district or local name (opt)
	Commercial specifications: Class; Size (code or minimum - maximum diameter); Net weight (opt).	**Official control mark:** (opt)
8. CONTAMINANTS		
Heavy metals	Grapefruits shall comply with those maximum levels for heavy metals established by CAC for this commodity.	
Pesticide residues	Grapefruits shall comply with those MRLs established by CAC for this commodity.	
9. HYGIENE	**Preparation and handling:** in accordance with the appropriate section of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.	**Microbiological criteria:** the produce shall comply with any microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 21-1997).

FUNDACIÓN ANGEL REY / freshfel EUROPE	**MARKETING STANDARDS** **PUMMELOS (*Citrus grandis* (L.) Osbeck)**	

PRODUCT: **PUMMELOS (*Citrus grandis* (L.) Osbeck)** (syn. *C. maxima* Merr.) VARIETIES: Several	FILE NUMBER: **20** VERSION: **1** SOURCE: **CA**

0. REFERENCE	Codex standard 214-1999
1. DEFINITION	This standard applies to pummelos for supply fresh to the consumer. Pummelos for industrial use are excluded.

2. MINIMUM REQUIREMENTS

Whole, firm, sound, clean, free of damage caused by pests and by low temperature, free of abnormal external moisture, free of any foreign smell and/or taste.

3. DEVELOPMENT AND MATURITY REQUIREMENTS

Carefully picked pummelos, which have reached an appropriate degree of development and ripeness (according to variety and/or commercial type; and growing area). Development and condition must be such as to enable them to withstand transport and handling, and to arrive in satisfactory condition at destination.

- **Maturity requirements:** TSS $\geq$ 8%.
- **Colouring:** typical of the variety and/or commercial type on $\geq$ 2/3 of the surface (also taking into account the time of picking).

4. CLASSIFICATION

'Extra' Class: Superior quality. Characteristic of the variety and/or commercial type. Clean and well shaped. Only very slight superficial defects allowed, provided these do not affect appearance, quality, postharvest life or presentation.

Tolerance: 5% by number or weight out of standards, but within Class I standards or, exceptionally, coming within the tolerances of that class.

Class I: Good quality. Characteristic of the variety and/or commercial type. Defects admitted, if these do not affect appearance, quality, postharvest life or presentation; and in no case affect the pulp (total area affected $\leq$ 10%):

- slight defects in shape and/or colouring,
- slight skin defects (inherent in fruit formation) and slight skin healed defects (due to mechanical causes).

Tolerance: 10% by number or weight out of standards, but within Class II standards or, exceptionally, coming within the tolerances of that class.

Class II: Defects admitted, provided they retain their essential characteristics of quality and presentation; and in no case affect the pulp (total are affected $\leq$ 15%):

- defects in shape and/or colouring,
- skin healed defects due to mechanical causes.

Tolerance: 10% by number or weight out of standards, with the exception of produce affected by deterioration affecting consumption (e.g. rotting).

5. SIZING By weight or diameter	**By weight or diameter:** (maximum diameter of the equatorial section).	
	Minimum weight: 700 g	Minimum diameter: 12 mm
	Table to be developed.	
	Size tolerance: 10% by number or weight of pummelos out of specifications, but within the size immediately above and/or below that indicated on the package.	
6. PRESENTATION	**Uniformity:** in origin, variety and/or commercial type, quality, size and colour. The visible part must be representative of the entire contents.	
	Packaging: The produce must be packed in such a way to assure its protection. Materials must be new, clean and of a proper quality. Non-toxic ink or glue. Pummelos shall be packed in each container in compliance with the Recommended International Code of Practice for Packaging and Transport of Tropical Fresh Fruit and Vegetables (CAC/RCP 44-1995). Containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the pummelos. Packages must be free of all foreign matter and smell.	
7. MARKING	**Consumer packages:**	
	In addition to the requirements of the Codex General Standard for the Labelling of Pre-packaged Foods (Codex Stan 1-1985): **Nature of the produce:** if not visible from the outside, name of produce and optionally, name of variety.	
	Non-retail containers:	
	Information: legible and indelibly marked, grouped on same side, visible from the outside, or in documents accompanying the shipment. For produce transported in bulk, these particulars appear on a document going with the goods.	
	Identification: name and address of exporter, packer and/or dispatcher. Identification code (opt).	
	Nature of the produce: - name of the produce, if not visible from the outside, - name of variety and/or commercial type (opt).	**Origin:** Country (comp) and district or local name (opt)
	Commercial specifications: Class; Size (code or minimum - maximum weight or diameter); Net weight (opt).	**Official control mark:** (opt)

8. CONTAMINANTS

Heavy metals	Pummelos shall comply with those maximum levels for heavy metals established by CAC for this commodity.
Pesticide residues	Pummelos shall comply with those MRLs established by CAC for this commodity.

9. HYGIENE	**Preparation and handling:** in accordance with the appropriate section of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.	**Microbiological criteria:** the produce shall comply with any microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 21-1997).

Source: http://www.freshquality.eu/php/document.php?catdoc_id=49.

Appendix 41

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

Department für Agrarökonomie und Rurale Entwicklung

Arbeitsgebiet Betriebswirtschaftslehre des Agribusiness

Prof. Dr. Ludwig Theuvsen

Fragebogen zur Doktorarbeit:

'Identification of Export Opportunities for Syrian Citrus Growers to the EU: A Supply Chain Perspective'

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GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

Wertschöpfungskette von Zitrusfrüchten in Deutschland

Sehr geehrte Damen und Herren,

wir möchten Sie höflich bitten an folgender Umfrage zum Zitrusfrüchtemarkt in Deutschland und Europa teilzunehmen. Die Umfrage ist Teil einer Doktorarbeit an der Georg-August-Universität Göttingen mit dem Titel: 'Identification of Export Opportunities for Syrian Citrus Growers to the EU: A Supply Chain Perspective'.

Ziel der Doktorarbeit ist es, die Marktchancen für Zitrusfrüchte aus Syrien in Europa und speziell auch in Deutschland zu verbessern. Dazu werden detaillierte Informationen über die Europäische Wertschöpfungskette gesammelt und ausgewertet. Aus den gewonnenen Erkenntnissen kann die Effizienz der Supply Chain verbessert werden, indem Chancen zur syrisch-europäischen Zusammenarbeit entlang der Kette identifiziert werden und mögliche Hinderungsgründe erkannt werden. Hierfür ist es wichtig, die Europäischen Konsum- und Absatztrends am Zitrusfrüchtemarkt zu erforschen, um so strategische Hilfe für Syrische Produzenten und Exporteure leisten zu können.

Ebenfalls soll die Doktorarbeit untersuchen, welchen Einfluss das Europa-Mittelmeer-Assoziationsabkommen, das im Oktober 2004 zwischen der EU und Syrien initiiert wurde, auf Syrische Zitrusfrucht-Exporte in Europäische Märkte hat. Das Assoziationsabkommen wird vermutlich zu verbesserten Marktchancen für Syrische Zitrusfrüchte führen und ist ein wichtiger Schritt in Richtung einer progressiven Öffnung der Europäischen Märkte.

Wie bereits erwähnt, ist diese Umfrage ein Teil der erläuterten Doktorarbeit. Ziel dieser Umfrage ist es, ein besseres Verständnis über die Supply Chains von Orangen, Mandarinen/Clementinen, Zitronen, Limetten, Grapefruits und Pampelmusen zu erlangen, um Zusammenarbeit und Partnerschaften entlang der Kette fördern zu können. Dadurch könnten Marktzugang, Versorgungssicherheit und Produktqualität verbessert werden.

Die Befragung ist anonym. Ihre Teilnahme ist eine wesentliche Voraussetzung für das Gelingen meiner Arbeit.

Herzlichen Dank für Ihre Mitarbeit!

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GÖTTINGEN

Zum Anfang möchten wir Ihnen einige Fragen zu Ihrer Person stellen.

1. Welches Geschlecht haben Sie?

☐ weiblich ☐ männlich

2. In welchem Jahr sind Sie geboren? **19_______**

3. In was für einem Ort befindet sich Ihr Geschäft?

In einem kleineren Ort (bis 500 Einwohner)	☐
In einem größeren Ort (bis 5.000 Einwohner)	☐
In einem kleineren Stadt (bis 20.000 Einwohner)	☐
In einem größeren Stadt (bis 100.000 Einwohner)	☐
In einer Großstadt (bis 500.000 Einwohner)	☐
In einer Großstadt mit mehr als 500.000 Einwohnern	☐

4. Bitte nennen Sie die Postleitzahl Ihres Firmensitzes __________

5. Sind Sie:

☐ Einzelhändler? ☐ Großhändler?

6. Welche Fläche haben Ihre Geschäftsräume?

Verkaufsraum in m²	
Übrige Geschäftsräume in m²	

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7. Wie viele Arbeitnehmer beschäftigen Sie in Ihrem Unternehmen? __________

8. Seit wann existiert Ihr Unternehmen? __________

9. Bitte beantworten Sie die folgenden Fragen zu Ihrer Kundenstruktur.

Wie viele Kunden haben Sie täglich?	
Wie viel % Ihrer Kunden sind Stammkunden?	

10. Wie hoch ist Ihr jährlicher Umsatz (€)?

falls Sie Einzelhändler sind:		falls Sie Großhändler sind:	
☐ 0 – 20.000	☐ 20.000 – 40.000	☐ weniger als 100.000	☐ 100.000 - 250.000
☐ 40.000 – 60.000	☐ 60.000 – 80.000	☐ 250.000 - 500.000	☐ 500.000 - 750.000
☐ 80.000 – 100.000	☐ mehr als 100.000	☐ 750.000 - 1.000.000	☐ mehr als 1.000.000

11. Bitte geben Sie im Folgenden Ihre Warengruppenumsätze (in % des Gesamtumsatzes) an.

Gemüse	
Zitrusfrüchte	
Anderes Obst	
Sonstiges	
Summe	*100%*

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12. Welcher prozentuale Anteil der folgenden Warengruppen entfällt in Ihrem Unternehmen auf Produkte aus dem ökologischen Landbau?

Gemüse	(%)
Zitrusfrüchte	(%)
Anderes Obst	(%)
Sonstiges	(%)

13. Bitte zeigen Sie in der folgenden Tabelle, wie Ihr jährlicher Gesamtabsatz von Zitrusfrüchten über die Quartale verteilt ist.

Zitrusfrüchte verkauft im...		% des jährlichen Absatzes
1	1. Quartal (Januar – März)	
2	2. Quartal (April – Juni)	
3	3. Quartal (Juli – September)	
4	4. Quartal (Oktober - Dezember)	
	Summe	*100%*

14. Wie wichtig ist das Herkunftsland der Zitrusfrüchte für Sie als Händler?

Sehr wichtig	Eher wichtig	Teils/teils	Eher nicht wichtig	Nicht wichtig
☐	☐	☐	☐	☐

15. Wie wichtig ist das Herkunftsland der Zitrusfrüchte für die Kaufentscheidung Ihrer Kunden?

Sehr wichtig	Eher wichtig	Teils/teils	Eher nicht wichtig	Nicht wichtig
☐	☐	☐	☐	☐

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16. Wie wichtig ist die ökologische Produktion bei Zitrusfrüchten für die Kaufentscheidung Ihrer Kunden?

Sehr wichtig	Eher wichtig	Teils/teils	Eher nicht wichtig	Nicht wichtig
☐	☐	☐	☐	☐

17. Wie stark präferieren Sie als Händler Zitrusfrüchte aus den folgenden genannten Ländern?

	Land	Präferiere stark	Präferiere eher	Teils/teils	Lehne eher ab	Lehne voll und ganz ab
1	Spanien	☐	☐	☐	☐	☐
2	Italien	☐	☐	☐	☐	☐
3	Südafrika	☐	☐	☐	☐	☐
4	Israel	☐	☐	☐	☐	☐
5	Marokko	☐	☐	☐	☐	☐
6	China	☐	☐	☐	☐	☐
7	Türkei	☐	☐	☐	☐	☐
8	Andere Länder	☐	☐	☐	☐	☐

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18. Welchen Anteil Ihrer Zitrusfrüchte beziehen Sie aus den folgenden Ländern? Wie schätzen Sie diesen Anteil in 5 Jahren ein?

Bitte geben Sie an, wie viel % Ihrer jeweiligen Produkte (Orangen und Mandarinen / Clementinen; Zitronen und Limetten; Grapefruit und Pampelmusen) aus dem jeweiligen Land kommen.

	Land	**Anteile (%) des letzten Jahres**			**Erwartete Anteile (%) in 5 Jahren**		
		Orangen und Mandarinen / Clementinen	**Zitronen und Limetten**	**Grapefruit und Pampelmusen**	**Orangen und Mandarinen / Clementinen**	**Zitronen und Limetten**	**Grapefruit und Pampelmusen**
1	Spanien						
2	Italien						
3	Südafrika						
4	Israel						
5	Marokko						
6	China						
7	Türkei						
8	Andere Länder						
	Summe	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

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19. Bitte bewerten Sie die folgenden Qualitätskriterien auf einer Skala von 1 (nicht wichtig) bis 5 (sehr wichtig) <u>bezogen auf die Produktgruppen.</u> *(Orangen und Mandarinen / Clementinen; Zitronen und Limetten, Grapefruit und Pampelmusen)*

1: Nicht wichtig	2: Eher nicht wichtig	3: Teils/teils	4: Eher wichtig	5: Sehr wichtig

	Qualitätskriterium	**Produktgruppe**		
		Orangen und Mandarinen / Clementinen	**Zitronen und Limetten**	**Grapefruit und Pampelmusen**
1	Frei von Mängeln			
2	Größe			
3	Reife			
4	Farbe der Schale			
5	Farbe des Fruchtfleisches			
6	Beschaffenheit des Fruchtfleisches			
7	Geruch			
8	Geschmack			
9	Sorte und Herkunft			

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20. Bitte bewerten Sie die folgenden Vertragsbedingungen auf einer Skala von 1 (nicht wichtig) bis 5 (sehr wichtig) <u>bezogen auf die Produktgruppen.</u> (Orangen und Mandarinen / Clementinen; Zitronen und Limetten, Grapefruit und Pampelmusen)

1: Nicht wichtig	2: Eher nicht wichtig	3: Teils/teils	4: Eher wichtig	5: Sehr wichtig

	Vertragsbedingung	**Produktgruppe**		
		Orangen und Mandarinen / Clementinen	**Zitronen und Limetten**	**Grapefruit und Pampelmusen**
1	Günstige Zahlungsbedingungen			
2	Preis			
3	Marketing-Unterstützung / -Förderung			
4	Verlässlichkeit der Qualitätseinstufung			
5	Verpackung / Präsentation			
6	Termingerechte Lieferung			
7	Kontinuierliche Belieferung			
8	Einfache Bestellung			
9	Andere (bitte unterhalb der Tabelle angeben!)			

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21. Bitte bewerten Sie Ihre Zufriedenheit mit den folgenden Qualitätskriterien auf einer Skala von 1 (sehr unzufrieden) bis 5 (sehr zufrieden) <u>bezogen auf das jeweilige Herkunftsland</u>.

1: Sehr unzufrieden	2: Eher unzufrieden	3: Teils/teils	4: Eher zufrieden	5: Sehr zufrieden

	Qualitätskriterium	**Land**						
		Spanien	**Italien**	**Süd-afrika**	**Israel**	**Marokko**	**China**	**Türkei**
1	Frei von Mängeln							
2	Größe							
3	Reife							
4	Farbe der Schale							
5	Farbe des Fruchtfleisches							
6	Beschaffenheit des Fruchtfleisches							
7	Geruch							
8	Geschmack							
9	Sorte und Herkunft							

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22. Bitte bewerten Sie Ihre Zufriedenheit mit den genannten Vertragsbedingungen auf einer Skala von 1 (sehr unzufrieden) bis 5 (sehr zufrieden) <u>bezogen auf das jeweilige Herkunftsland</u>.

1: Sehr unzufrieden	2: Eher unzufrieden	3: Teils/teils	4: Eher zufrieden	5: Sehr zufrieden

	Vertrags-bedingung	**Land**						
		Spanien	**Italien**	**Süd-afrika**	**Israel**	**Marokko**	**China**	**Türkei**
1	Günstige Zahlungs-bedingungen							
2	Preis							
3	Marketing-Unterstützung / -Förderung							
4	Verlässlichkeit der Qualitäts-einstufung							
5	Verpackung / Präsentation							
6	Termingerechte Lieferung							
7	Kontinuierliche Belieferung							
8	Einfache Bestellung							
9	Andere (bitte unterhalb der Tabelle angeben!)							

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Dieser Teil der Umfrage bezieht sich speziell auf Zitrusfrüchte aus Syrien. Daher folgen nun einige Fragen über Syrische Zitrusfrüchte und deren Herkunftsland.

23. Haben Sie jemals Syrische Zitrusfrüchte in Ihrem Geschäft verkauft? Bitte nennen Sie den Grund!

☐Ja! ____

____

☐ Nein! ____

____

24. Welche Erwartungen haben Sie bezüglich Zitrusfrüchten aus Syrien?

	Stimme voll und ganz zu	**Stimme eher zu**	**Teils/teils**	**Stimme eher nicht zu**	**Lehne voll und ganz ab**
Sehr hohe Qualität	☐	☐	☐	☐	☐
Verlässliche Vertragspartner	☐	☐	☐	☐	☐
Gutes Preis-Leistungs-Verhältnis	☐	☐	☐	☐	☐
Große Geschmacksvielfalt	☐	☐	☐	☐	☐
Günstige Zahlungsbedingungen	☐	☐	☐	☐	☐
Begleitende Marketing-Unterstützung	☐	☐	☐	☐	☐
Termingerechte Lieferung	☐	☐	☐	☐	☐
Verlässliche Versorgung	☐	☐	☐	☐	☐

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25. Wussten Sie, dass…

… Zitrusfrüchte aus Syrien aufgrund eines integrierten biologischen Kontroll-Programms frei von Pestizidrückständen sind? (95% der Syrischen Zitrusfrüchte werden biologisch angebaut und ihre Qualität wird als hoch eingeschätzt)

a) ☐ Ja ☐ Nein

b) Denken Sie, dass diese Eigenschaft einen Wettbewerbsvorteil für Syrische Zitrusfrüchte auf dem deutschen Markt darstellt?

Stimme voll und ganz zu	Stimme eher zu	Teils/teils	Stimme eher nicht zu	Lehne voll und ganz ab
☐	☐	☐	☐	☐

26. Wussten Sie, dass…

… es in Syrien mehrere Sorten und Kulturen an Zitrusfrüchten gibt, die den Vorteil einer mittel-späten und frühen Reife haben (Reife ca. 1 Monat früher als in Europäischen Ländern)?

a) ☐ Ja ☐ Nein

b) Denken Sie, dass diese Eigenschaft einen Wettbewerbsvorteil für Syrische Zitrusfrüchte auf dem deutschen Markt darstellt?

Stimme voll und ganz zu	Stimme eher zu	Teils/teils	Stimme eher nicht zu	Lehne voll und ganz ab
☐	☐	☐	☐	☐

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27. Wussten Sie, dass…

… die Produktionskosten für Zitrusfrüchte in Syrien sehr niedrig sind? Dadurch sind die Hoftor-Preise geringer als in der EU-Region.

a) ☐ Ja ☐ Nein

b) Denken Sie, dass diese Eigenschaft einen Wettbewerbsvorteil für Syrische Zitrusfrüchte auf dem deutschen Markt darstellt?

Stimme voll und ganz zu	Stimme eher zu	Teils/teils	Stimme eher nicht zu	Lehne voll und ganz ab
☐	☐	☐	☐	☐

28. Angenommen, Sie erhalten eine Importgenehmigung für Syrische Zitrusfrüchte: Bitte bewerten Sie die folgenden Statements.

	Stimme voll und ganz zu	Stimme eher zu	Teils/teils	Stimme eher nicht zu	Lehne voll und ganz ab
Ich werde Syrische Zitrusfrüchte verkaufen.	☐	☐	☐	☐	☐
Am deutschen Markt gibt es eine genügende Menge an Zitrusfrüchten aus unterschiedlichen Ländern. Ein Import von Syrischen Zitrusfrüchten ist daher nicht notwendig.	☐	☐	☐	☐	☐
Deutsche Konsumenten mögen es, neue Sorten aus neuen Ländern zu probieren.	☐	☐	☐	☐	☐

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29. Welche Chancen sehen Sie für Syrische Zitrusfrucht-Produzenten, ihren Marktanteil bzw. ihre Profitabilität in Deutschland bzw. Europa zu erhöhen?

30. Haben Sie Anmerkungen oder Kommentare bezüglich der Wertschöpfungskette von Zitrusfrüchten, die Sie gerne mitteilen würden?

Vielen Dank, dass Sie sich die Zeit genommen haben, an dieser Umfrage teilzunehmen!

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