

CAN THE SMALL-SCALE PRODUCERS OF NAVEL ORANGE RESIST THE STABILITY OF THE FARM GATE PRICES AND THE SOAR OF THE INPUT PRICES WITHIN THE BIOPHYSICAL FACTORS?

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Abstract Egypt Navel orange planted area reached about 174.6 thousand acres during the average period of 2012-2020. Delta governorates is the major orange's productive region in Egypt with 97.4% of the total production of the country. 87.2% of orange's planted area came from only five Delta governorates. The top planted area governorates are El Behera with an acreage area representing about (41.3%), followed by Qalyoubia (16.7%), Ismailia (11.1%), Menufia (9.54%) and Sharqiya (8.52%) of total planted areas during the period 2012-2020. El-Behera is the major Navel orange's productive governorate in Egypt with (43.9%) of Egyptian total production of Navel orange, followed by Qalyoubia (18.8%), Menufia (9.2%), Ismailia (8.3) and Sharqiya (7.7%) of Navel orange total production during the period 2012-2020. In recent years, small scale farmers have experienced technical, environmental and economic problems. This study will shade light on the economic problems because fruit prices have come to a standstill or even decreased while the production costs have risen continuously. The present study depends on data collected from the private small farm planted with Washington Navel orange trees [*Citrus sinensis* L.(Osbeck)] since 1968, which is located in Minyat as Siba, Benha-Qalyoubia governorate, Egypt. The result shows that the average values of fertilizers, pests and diseases account for a large proportion of the total costs, representing about 42.57% and 26.47% respectively from the total production costs during 2012-2022. Prices received for Navel oranges fluctuate markedly from year to year. This combined with fluctuations in yields. Over the period 2012 to 2022 farm gate prices of Navel orange averaged 2905 Egyptian pound (LE) per ton, with the minimum of LE 1750 per ton in 2012 and the maximum of LE 4000 per ton in the 2019, 2020 and 2021.

Keywords: *Agricultural inputs, Farm gate price, Navel orange, Production costs, Revenue to cost ratio, Small-scale producers, Value chain*

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INTRODUCTION

Agriculture sector is the largest contributing sector to employment in Egypt, with up to 21% of employed Egyptians working in this sector. Construction and building, wholesale and retail trade along with manufacturing industries ranked next with 14%, 13.4% and 12.5%, respectively. The share of value added by the agriculture, forestry and fishing sector to the gross domestic product in Egypt increased by 0.3% points since

2020. In total, the share amounted to 11.83% in 2021 (World Bank, 2020). The Egyptian total cultivated area (arable land plus permanent crops) is 9.92 million acre in 2020, or about 4% of the total area of the country. Arable land is about 8 million acres, representing about 81% of the total cultivated area and permanent crops occupy the remaining 1.85 million acres representing about 19% of the total cultivated area (CAPMAS, 2021). Egypt is the seventh largest world producer of citrus fruit after China, Brazil, India, Mexico USA

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Orchard Management

Trees are planted 5 x 5 meters apart with total number of trees were 170 trees/acre. All trees were grown in heavy (clay) soil and irrigated by a surface irrigation system. The total amount of water applied per annum per acre was about 4320 m³, irrigation schedule during the season is 18 times, may be at 15- to 21-day intervals.

Statistical Analysis

Descriptive analysis for main production indicators of Egyptian orange in 2020 and Navel orange during the period (2012-2020) was performed such as mean, maximum, minimum, growth rate and relative importance by using data from Economic Affairs Sector, Ministry of Agriculture and Land Reclamation (MALR) during the study period. Linear trend analysis was used to test the relationship between planted area, total production of Navel orange and time trend was performed at $p < 0.05$ (Gardner & Altman, 1986).

Moreover costs of pruning, hoeing, fertilizers, irrigation and chemical control were calculated based on the private farm agricultural records for the 2012-2022 seasons. The total return is calculated as follows:

$$\text{Total return} = \text{total revenue} - \text{production cost}$$

According to McCormick & Schmitz (2001), the value chain mapping enables visualizing the flow of the product from conception to end consumer through various actors.

It also helps to identify the different actors involved in the Navel orange value chain in the study area and to understand their roles and linkages. The Navel orange in the study area marketing channels was categorized into two channels. The first channel covered distribution of Navel oranges from farm through various local traders to city consumers; while second channel involved distribution of Navel oranges from farm through traders to export station. Consequently, the current value chain map of Navel orange fruit in the study area is shown in (Figure 2).

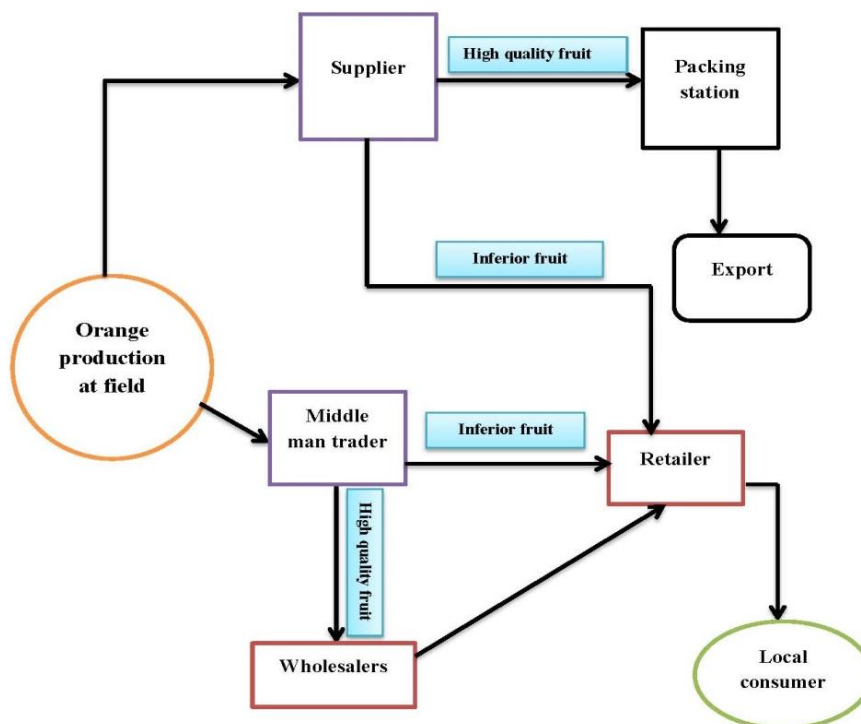


Figure 2. Current value chain of Navel orange in the research Area.

RESULTS

Economic Indicators of Egyptian Orange

- **Planted Area**

Producers prefer to cultivate oranges over other fruit types due to their high export demand

and value as well as a well-established supply chain that allows small producers (who would otherwise not have the capacity to export) to capitalise on export markets by selling their crop to larger commercial farms or the packaging station and exporters.

Planted area of oranges in Egypt in 2020 was 327 thousand acres, which represents about 66% of the citrus planted area. Oranges are grown in almost all of Egypt’s governorates; however, the Delta governorates are the main producing areas with 92% of the total production of the country followed by Middle Egypt region (3%) and Upper Egypt (2.88%) of the total Egyptian production (Figure 3). The delta governorates of El-Beheira, Ismailia, Sharqiya, Qalyoubia and Menufia are the

main producing areas of oranges with 85% of the total production (Figure 3).

• **Yield**

The data in Figure 3 showed that the yield of orange in the Delta governorates in 2020 ranged between a minimum value of 9.71 tonnes per acre in Ismailia and a maximum value of 12.22 tonnes per acre in Qalyoubia.

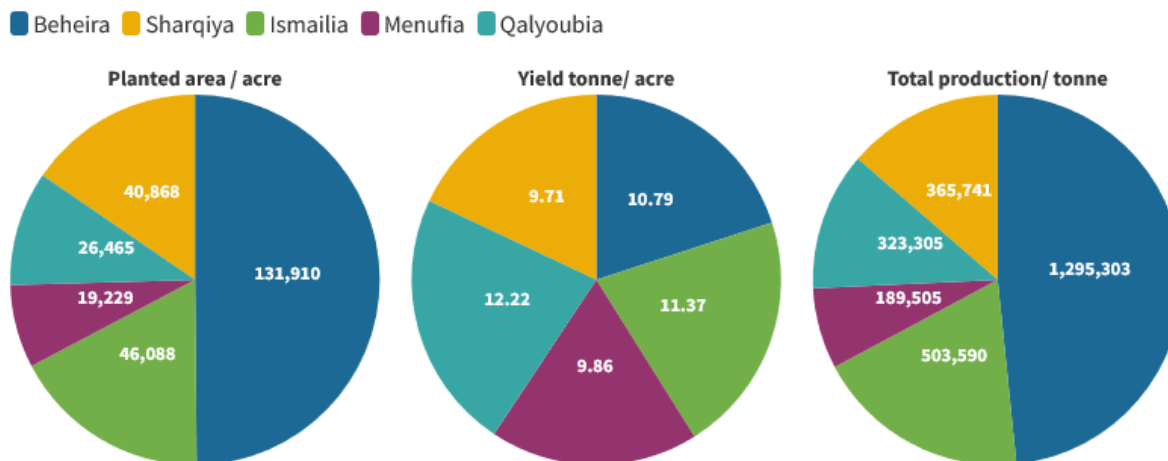


Figure 3. Planted area, yield and total production of orange top producer governorates in 2020.

• **Total production**

The increase in production is attributed to an increase in the cultivated area, following good agricultural practices and optimum weather conditions and temperatures during flowering of the trees which increased fruit set and production. Around half of Egypt’s orange production comes from commercial farms on reclaimed desert land established during the last three decades rather than the Nile Valley ,where the land ownership is an acre or less, and farmers cannot afford the necessary level of investment for sustainable orange production (MALR, 2021; USDA, 2022).

Data in Figure 3 showed that El- Beheira is the major orange’s productive governorate in Egypt with 1.3 million tonnes followed by Ismailia (503 million tonnes), Sharqiya (365.7 million tonnes) and Qalyoubia (323.3 million tonnes).

Navel Orange Domestic Profile in Egypt

Washington Navel is the key cultivar Navel orange grown in Egypt. There are other lesser known Navel orange cultivars such as Navelate, Navelina, Cara Cara, New Hall, Fisher, Lane Late, Leng and Fukumoto. Fruit color break starts in late September and ripening fruit dates extend from November to March. The fruit is seedless, medium to large-sized, with relatively rough skin in some

cultivar and soft skin in others. It has a sweet flavor with a fruit taste.

• **Planted area of navel orange**

Egypt Navel orange planted area reached about 174.6 thousand acres during the average period of 2012-2020. Delta governorates is the major orange’s planted region in Egypt with 97.4% of the total planted area of Egypt followed by Middle Egypt region (1.93%), Outside the Valley Governorates (0.65%) and Upper Egypt (0.01%) of the total planted area in Egypt (Table 1).

Moreover, 87.2% of orange’s planted area came from only five governorates located in Delta (El-Beheira including Nubaria, Qalyoubia, Ismailia, Menufia, and Sharqiya).

The top governorates are El-Beheira with a planted area representing about (41.3%), followed by Qalyoubia (16.7%), Ismailia (11.1%), Menufia (9.54%) and Sharqiya (8.52%) of total planted area during the study period (Figure 4). Equations 1 and 2 in Table 2 indicated statistical significance falling trend in the planted area in El-Beheira and Qalyoubia during the study period at 5% significant level. On the other hand, the trend pattern indicated a significant rise in the planted area in Menufia during the study period at 5% significant level (Equation 4 in Table 2).

Table 1. Average planted area, yield and total production of Navel orange during 2012- 2020.

Regions	Planted area (acre)	%	Yield (ton/acre)	Total Production (tonnes)	%
Delta	170110	97.4	9.54	1623463	98.15
Middle Egypt	3375	1.93	8.09	27328	1.65
Upper Egypt	26	0.01	7.00	184	0.01
Outside Valley	1128	0.65	2.75	3108	0.19
Total	174639	100	9.47	1654082	100

Source: Economic Affairs sector, Ministry of Agriculture and Land Reclamation, Egypt.

Table 2. Results of the linear trend analysis of Navel orange planted area and total production during the period 2012-2020.

Variables	β	T _{test}	R ²	Average	Rate of change (%)	No
Total areas						
El- Behera	-2855.2	-6.06	0.84	68680	-4.2	1
Qalyoubia	-989.9	-8.97	0.92	27777	-1.4	2
Ismailia*	113.25	0.6	0.04	18456	0.2	3
Menoufia	747.3	-9.35	0.92	15852	1.1	4
Sharqiya*	-178.16	-0.86	0.09	14156	-0.3	5
Total production						
El- Behera*	-11538.8	-1.36	0.21	691493	-16.8	6
Qalyoubia*	-441.6	-0.14	0.002	296088	-0.6	7
Ismailia	21387.7	6.67	0.86	145658	31.1	8
Menoufia*	-3073.75	-1.87	0.33	130271	-4.5	9
Sharqiya*	3658.95	1.84	0.32	120693	5.3	10

*Statistically non-significant result.

R²: ratio of "explained" variance to the "total" variance of the dependent variable 'total area/ total production. The coefficient of determination indicating goodness-of-fit of the regression.

t: t-statistic for testing whether any of the coefficients might be equal to zero. Large values indicate that the null hypothesis can be rejected and that the corresponding coefficient is not zero.

p-value: expresses the results of the hypothesis test as a significance level. P-values smaller than 0.05 are taken as evidence that the population coefficient is nonzero.

Source: Compiled and calculated from data in Fig. 4 and 6.

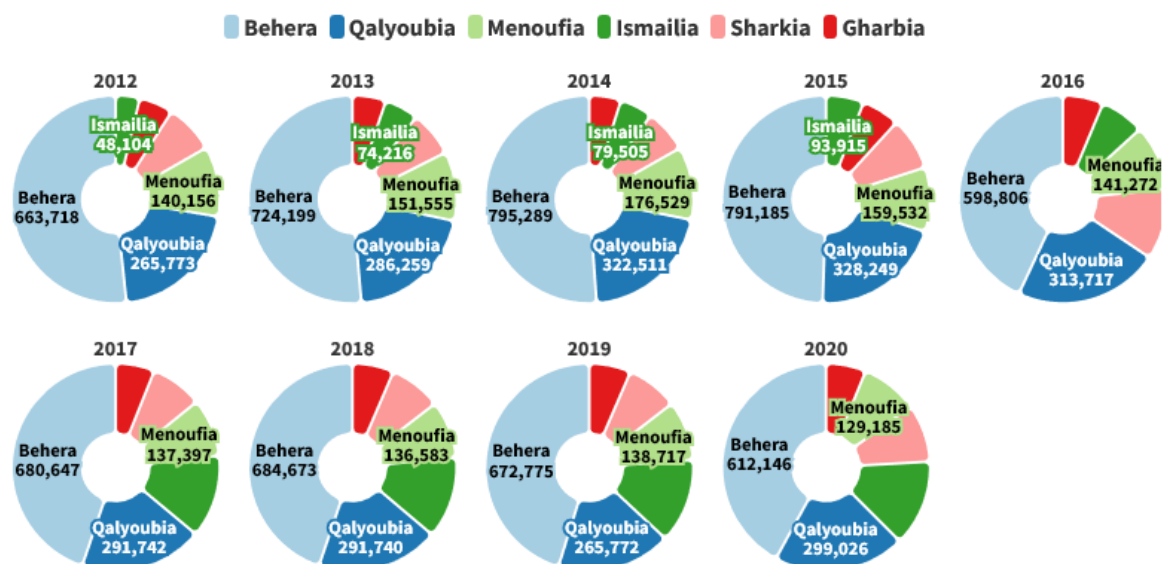


Figure 4. Navel orange planted area of top producer governorates during 2012-2020 in acres.

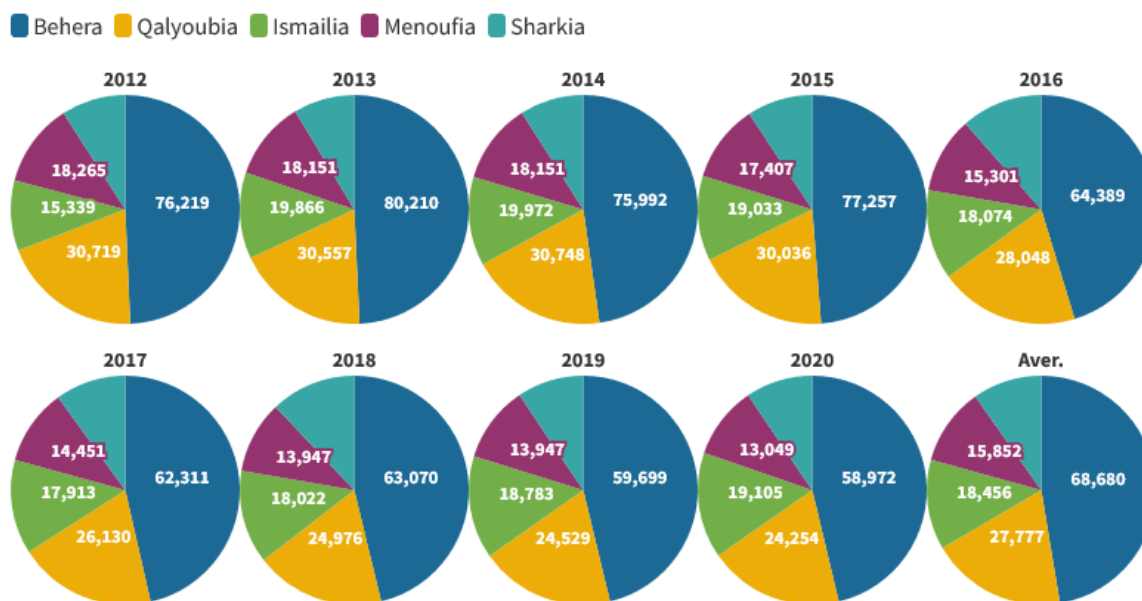


Figure 5. Navel orange yield of top producer governorates during 2012-2020 in tonnes.

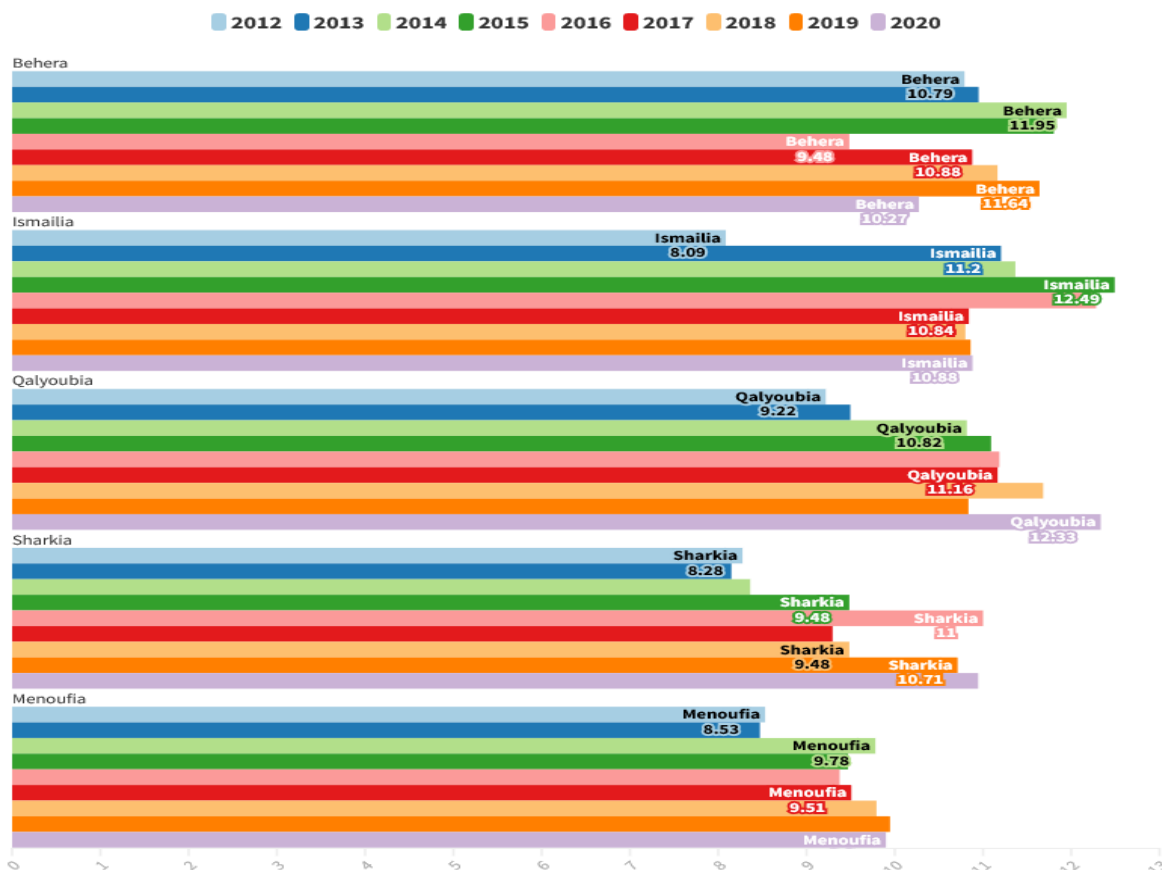


Figure 6. Navel orange total production of top producer governorates during 2012- 2020 in tonnes.

• **Yield of Navel orange**

Navel orange yield fluctuation from year to year may reflect transitive events such as bad weather. The data in Figure 5 shows that the yield of Navel orange in the Delta governorates during

the period of 2012-2020. In Qalyoubia yield reached a minimum value of 9.2 tonnes per acre in 2012, and a maximum value of 12.3 tonnes per acre in 2020. Likewise, Navel orange yield in El-Behera reached a minimum value of 9.4 tonnes per acre in

2016 and a maximum value of 11.9 tonnes per acre in 2014.

- **Total production of Navel orange**

Data in Figure 6 shows that El-Behera is the major Navel orange's productive governorate in Egypt. Average of the total production reached 691.5 thousand tonnes, (43.9%) of Egyptian total production of Navel orange, followed by Qalyoubia (18.8%), Menufia (9.2%), Ismailia (8.3) and Sharqiya (7.7%) of navel orange total production. The trend analysis of total production indicated a statistical significant increasing in orange total production inside Ismailia governorate during the study period at 5% significant level with 31.1% yearly rate of change (Table 2).

Navel Orange Production in the Research Area (Minyat as Siba)

Table 3. Costs per acre by operation to produce Navel orange in the research area during the period 2012- 2022 in LE.

Cost Items	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Aver.	%
Pruning	700	780	850	900	1000	1100	1150	1200	1300	1400	1600	1089	6.26
Preparation & Hoeing	1100	1200	1400	1800	2000	2200	2400	2600	2700	2900	3000	2118	12.18
Irrigation	1000	1200	1200	1250	1250	1400	1500	1500	1500	1500	1500	1345	7.74
Fertilisers *													
- Manure	0	700	0	750	0	950	0	1500	0	1750	0	514	2.95
- Nitrogen	1425	1425	1350	1425	1500	2250	2475	2550	2625	2775	2800	2055	11.82
- Phosphorus	450	500	600	550	600	650	650	700	800	1000	1000	682	3.92
- Potassium	1500	1500	1500	2100	2100	1800	1950	1500	2400	2400	2500	1932	11.11
- Sulphur	300	350	550	575	600	400	400	400	500	500	500	461	2.65
- Micronutrients	720	800	900	1000	1200	1200	2000	2500	2800	2900	2950	1725	9.92
Pests & diseases	3375	3540	3890	4410	4536	4600	4440	5040	5490	5730	5750	4618	26.56
Herbicides	570	500	500	600	800	900	1000	1000	1000	1200	1250	847	4.87
Total costs**	11140	12495	12740	15360	15586	17450	17965	20490	21115	24055	22850	17386	100.00

*Chemical fertilisers are: Ammonium Nitrate (33.5% N) - Calcium Superphosphate (15.5% P₂O₅) - Potassium Sulfate (48% K₂O) - Micronutrients (Iron, Manganese, Boron and Zinc).

** Total costs without rent

- **Evolution of Navel orange yield, farm gate price and total revenue during the period 2012- 2022**

Prices received for Navel oranges fluctuate markedly from year to year. This combined with fluctuations in yields and results in big changes in total revenues during 2012-2022 (Table 4). Over the period 2012 to 2022 farm gate prices of Navel orange averaged LE 2905 per ton, with the minimum of LE 1750 per ton in 2012 and the maximum of LE 4000 per ton in the 2019, 2020 and 2021.

The average yield of Navel orange in the research area was 9 tonnes during 2012-2022. In 2022, the Navel orange yield in the research area increased to reach 10 tonnes per acre; stabilizing during the period of 2012-2014, the yield, however, showed a fluctuation trend pattern from 2015 to 2021. The Navel orange yield reached the peak

The aim of this part is to describe the Navel orange profile in the research area, based both on the data derived from farm records and official sources, providing relevant statistical information.

- **Production Cost Analysis of Navel Orange During the Period 2012-2022**

The data in Table 3 shows that average values of all fertilizers and pests and diseases account for a large proportion of the total costs, representing about 42.38% and 26.56% respectively from the total production costs during 2012-2022. The total production cost per acre of Navel orange cultivation shows a trend of the increase year by year, among which preparation and hoeing, Pruning and herbicides costs grow faster by about 172%, 128% and 119% respectively from the base year (2012).

level at 11 tonnes per acre in 2018; however, future yield figures may still be impacted by adverse weather conditions. Data in (Table 4) shows that total revenue reached the maximum in 2022 with LE 37000 and the minimum of LE 15750 in 2012, while the average total revenue during the study period was LE 27118. In 2022 the total revenue was LE 37000, while production costs reached LE 22850, this mean only LE 14150 was reward grower for his labor and investment in Navel orange. It is clear that the Navel orange small growers are earning around half of minimum wages per year, compared to average earnings of all employees in the economy around LE 26400 per year.

With this information, it is important to point on how much struggle it is for Navel orange small farmers to sustain their kids and themselves.

Table 4. Evolution of farm gate price, yield and total revenue per acre for the research area during the period 2012-2022.

Years	Farm gate price (LE/tonne)	Yield (Tonnes)	Total revenue (LE)	Production costs (LE)	Cost per unit LE/kg	Revenue to cost ratio	Water profitability (LE/m ³) **
2012	1750	9	15750	11790	1.31	1.3	0.91
2013	1900	9	17100	12495	1.39	1.4	1.06
2014	2000	10	20000	12740	1.27	1.6	1.68
2015	2100	9.5	19950	15360	1.62	1.3	1.06
2016*	3000	9	27000	15586	1.73	1.7	2.64
2017	3500	9	31500	17450	1.94	1.8	3.25
2018	2000	11	22000	17965	1.63	1.2	0.93
2019	4000	9	36000	20490	2.28	1.8	3.59
2020	4000	9	36000	21115	2.35	1.7	3.44
2021	4000	9	36000	24055	2.67	1.5	2.76
2022	3700	10	37000	22850	2.29	1.6	3.27
Average	2905	9	27118	17445			

*Increasing the farm gate price due to the 2016 deflation of Egyptian pound

** Water applied m³/ acre = 4320

Novel Orange Value Chain in the Research Area

The main flow of Navel oranges is distributed through traders who transport orange to urban market places or to the local retailers. Local traders buy the fruit (before being picked/ harvested) and those fruits are sold on an estimated price. Small producers in research area are used to sell their orange production to informal traders (middleman) in the same village or near at low prices, since the farmers lack capacity and market information to handle the seasonal gluts of navel oranges in such a situation, cheating and exploitation are unavoidable.

- **Navel orange distribution channels for the farm**

Various marketing channels were used to distribute oranges from the points of production to final consumers. For the research area, Navel orange fruits moved from producers to consumers through two different channels.

Distribution channel one involved movement of orange fruits from farm through supplier to the packing (export) station in Qalub city (10 km away from the farm). Manual sorting/grading of oranges is done at the farm, fruit that is damaged or is affected by scars and blemishes do not usually meet quality standards (inferior grade fruit) and is therefore discarded. Local retailers purchase Inferior grade fruit from producer directly and sold it in the road-sides or near city, town and village markets.

Distribution channel two involved movement of orange fruits from farm through trader who gave the best price for the orchards, which depend on the personal experiences, negotiations, yield estimation and prices of previous years from both side. Trader sells the good quality fruits to the wholesalers, while

inferior fruits taken by local retailer as in the distribution channels one.

For example, in the 2022 the price opened low and ended high. It started from LE 3.25/kg in early December and gradually increased to reach LE 3.7/kg between December 17th and 31st.

There were a lot of Navel traders (in the big farms more than 20 acres) who still had fruit on the tree till the end of the March; the reason is that the price reached the maximum about LE 5/kg. Yet, the following year's crop is down significantly.

Strengths, Weaknesses, Opportunities and Threats Analysis with Recommendations for Navel Orange Small Farmers in the Research Area

Analyzing the strengths, weaknesses, opportunities and threats (SWOT) is fundamental to the success and profitability of orange sector and is a valuable tool in strategic planning for the future. The following is the result of the analysis using SWOT technique for Navel orange in the research area:

Strengths

- Appropriate environmental conditions.
- High-level internal transport network.
- Ease of reach to all markets, airports, as a result of the unique geographical location of the farm.
- Soil quality suitable for cultivation.
- Family labor.

Weakness

- Little interaction among farmers and researchers and no platform for interaction.
- The absence of clear policies and clear plan for Navel orange production.
- Poor relationship between the farmers and other key player in orange sector.
- Availability & cost of skilled labor.

- Non-availability or accessibility to financial assistance for small farmers with zero interest rate.
- Weak market information system.
- Relatively very high agricultural inputs and capital costs.
- Low production due to inadequate agricultural practices.
- Navel yield is closely related to the weather (Heat waves, snow and frost disasters) will have a huge impact on the yield of navel orange in the near future.
- Knowledge gap of local farmers.

Threats

- There is a lack of coordination and integration among orange's value chain actors.
- Unknown pesticides use.
- Impact of climate change on Navel orange production.
- Urbanisation of villages and migration of farm labours into the urban areas or outside Egypt (Europe).
- Due to low profitability of oranges and high net profit of field crops, farmers replace orange trees with field crops such as wheat and corn.

Opportunities

- Increasing Egypt's exports by a large percentage to the current markets and opening new markets with new trade relations, such as China, Japan etc.
- High standard varieties matching with the international standards.

CONCLUSION

To encapsulate, small-scale Navel orange producers participate fully in meeting urban Navel orange demand, appropriate policy measures are needed which facilitate farm mechanization and reduce barriers limiting the adoption of environmentally sustainable approaches and technologies.

Intervention on strengthening access to education, credit service with zero interest rate, extension service, market information in addition to forward and backward linkage of farmers with the other stockholders are very important points which should get attention from responsible bodies.

It is recommended to properly ensure high income for the small producers to keep growing Navel orange.

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