Organic Agriculture in Egypt: Production Economics and Challenges (A Case Study of Fayoum Governorate)

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Abstract: The organic agriculture is no more a phenomenon of developed countries. The organic agriculture is revolutionary hitting the agriculture sector in Egypt. Fayoum governorate is considered the third between the Egyptian governorates with regard to the organic agricultural land and many researchers considered developing research about. The profitability of organic production is high when targeting international markets as the awareness of using organic products in Egypt is still in progress. Years of experience, area cultivated, and the growing method are constraints for the productivity per feddan of the organic production.
Enas E. Sadek and Ayman A. Shelaby. Organic Agriculture in Egypt: Production Economics and Challenges (A Case Study of Fayoum Governorate). Journal of American Science 2011; 7(9):208-215].(ISSN: 1545-1003). **http://www.americanscience.org**.

Keywords: Organic -agriculture

1. Introduction:

Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved (www.ifoam.org)

The phenomenon of organic agriculture has started in the 1930s and 1940s in the developed countries as a consequence of the raised dangerous effects of using synthetic fertilizers and pesticides in agriculture on both health and environment. In other words, they were looking for safe food that is free of pesticides and additives (**El-Meliegy, 2010**).

Organic foods were considered, for long time, a kind of luxury goods. In 2006, it was commercially practiced in 120 countries, representing 31 million hectares of certified croplands and pastures (~ 0.7 percent of global agricultural lands and an average of 4 percent in the European Union), and a market of US$40 billion (~ 2 percent of food retail in developed countries) (**Willer and Youssefi, 2007**).

In 2009, organic agriculture is no longer a phenomenon of developed countries. It's practiced in 160 countries and 37.2 million hectares of agricultural land are managed organically by 1.8 million farmers. The global sales of organic food and drink reached 54.9 billion US dollars in 2009 (**IFOAM 2011**).

The organic agriculture is growing fast as the demand for organic foods and drinks is developing rapidly. As a logical result of that the cultivated area allocated to this production technique increased about 30 millions hectares in 2010 operating by the world organic production technique to respond immediately to the world request increasing on the organic products and which has increasingly rapid growth rates about (30%) annually. Where the World market capacity of these products were increased by over 35 billion dollars in 2010, European union occupies about 46% of this market capacity, north America also occupies about 51% of this market capacity (www.ifoam.org)

In Africa, there are more than 0.4 million hectares of certified organic agricultural land. This constitutes about one percent of the world's organic agricultural land. There are at least 175'266 organic farmers. The countries with most organic land are Tunisia (154'793 Hectares), followed by Uganda (88'439 hectares) and South Africa (50'000 hectares). The highest shares of organic land are in Sao Tome and Prince (5.2 percent), Tunisia (1.6 percent) and Uganda (0.7 percent) (**Helga, 2008**). As farmers are practicing organic agriculture techniques un-officially, it's difficult to quantify the organic agricultural land. However non-certified organic systems (e.g. indigenous models that follow organic principles by intent or by default) of several million small farmers may represent at least an equivalent share in subsistence agriculture of developing countries (**Scialabba, 2007**).

The majority of certified organic produce is destined for export markets, with the large majority being exported to the European Union. The African market for organic products is still small. Certified organic products are currently recognized in only a few domestic markets, including Egypt, South Africa, Uganda, Kenya and Tanzania. For exports, most African countries rely upon foreign standards. To

date, the majority of organic production that is certified in Africa has been certified according to the EU regulation for organic products (**Helga, 2008**)

As for Egypt, although there is an augmented supply market for organic food gained from its significance as a safety production, high quality food and its positive environmental influences. The supply market is growing at much quicker rate than organic food consumption does (**IFOAM, 2009**). The logic interpretation for this situation is that organic agriculture is grown mainly for export market. As a result, the share of organic agricultural land has increased and has represented about 0.01% of the total agricultural land. It ranked third between African countries after Uganda and Tunisia (**IFOAM, 2008**)

Among Egypt governorates, Fayoum is ranked third with regard to the total organic agricultural land with a total area of 5126 hectares representing 19.8% of the total organic agricultural land in Egypt. Out of them 65.8% are H&S and 10.2% are vegetables (adopted from **El-Meliegy, 2010**)

Taking into consideration that H&S and vegetables are the main Egyptian agricultural exports, it's clear how important these two categories of organic products. Accordingly, this research will be focused on the two categories.

2. Methodology:

Statement of the study problem:

The main problem which extremely threatens the Egyptian organic production and reduces its competitive advantage in the foreign markets is the wrong and excessive using of chemical fertilizers and pesticides when producing horticultural crops based on the conventional agriculture techniques. This problem, now, not only affecting the international marketing of such crops but also has its impacts on the local marketing. The problem reflects its impact on producers leaves them with economic, social, and environmental problems. On the other hand, the organic agriculture techniques are not yet widely used by producers because of the argument about it and its profitability is still in play.

Objectives:

The study mainly aims at evaluating the economics of organic agriculture in Egypt. To achieve such goal the study will investigate the following objectives:

1- Shed light on the development of organic agriculture orientation in Egypt with a special focus on Fayoum governorate.
2- Determine and analyze the differences in the budgets of the main organic crops in Fayoum.

Data:

There are large numbers of data collection activities. Secondary data were collected through several organizations; Food and Agriculture Organization FAO, International Federation of Organic Agriculture movements IFOM, Egyptian Center of Organic Agriculture ICOA, and Fayoum Department of Agriculture.

Primary data were collected through questionnaire designed to serve the study objectives. A study sample of 240 producers was targeted in 2 villages; Abu-Gensho located in Abshway district and Omar Ibn Alkhatab located in Yousif AlSadek district. 120 producers were using conventional techniques and the other 120 producers were using organic agriculture techniques. As many of the producers are growing several crops, at least 60 questionnaires for each crop of the two categories were collected. Candidates of the study sample were growing the same species of the cultivated crops and data were collected during one season. All producers had at least three years of experience in growing organic crops. Crops under investigation are chamomile and spearmint as the common and most important organic H&S grown in Fayoum, and green beans and onions as the common and most important organic vegetables grown in Fayoum.

Hypothesis:

As the organic agriculture is moving rapidly as shown before, the study assumes that organic agriculture is the same as the conventional agriculture. Hence, our null hypothesis will be:

H0: economics of organic agriculture are expected to be the same as the economics of conventional agriculture.

H1: economics of organic agriculture are not expected to be the same as the economics of conventional agriculture.

Based on the above hypothesis, a balance sheet will be developed for each crop in order to compare the different items of costs and revenues (**Ednaa Loehman, 1996**). A T test will be developed to compare the means of the main balance sheet items. Analysis of Variance ANOVA will be developed to show the differences within and between groups of the study sample.

Overview of organic agriculture in Egypt:

The organic agricultural land in Egypt is almost doubling each 5 years. Table (1) indicates that organic agricultural land in Egypt has increased from 4020 hectares in 1998 to 9342 hectares in 2003 and to 19211 hectares in 2008 with annual growth rate of 17.2%. In addition, there are about 20,000 hectares of organic agricultural land in the transition period

waiting for official approval **(SEKEM, 2007).** As the main goal of organic farms in Egypt is to enhance the agricultural exports, the organic production in Egypt is driven from the demand of international markets.

Calculating the trends of the organic agricultural land for each of the categories shown in table (1), all areas of all the categories are significantly increasing during the period 1998 – 2008.

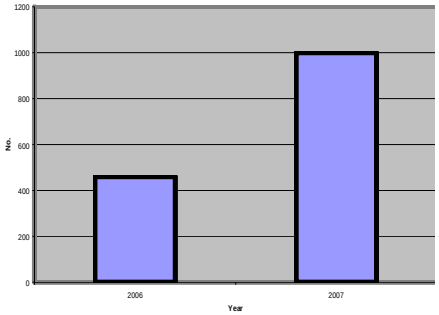
Table (1): Organic agricultural land in Egypt 1998 - 2008

	Organic agricultural land	Field crops	Vegetables	H&S	Fruits
1998	4020	2071	1181	548	219
2003	9342	4532	1764	2419	624
2008	19211	9484	3258	3164	2879

Source: Egyptian Center of Organic Agriculture (ECOA), unpublished agricultural records.

As the exportation of organic products generates high revenues, more farms are getting involved in applying organic agriculture methods. As figure (1) shows; the number of farms in Egypt was almost doubled in one year as it increased from 460 farms in 2006 to 1000 farms in 2007 (**Willer *et al.*, 2008**).

Figure (1): No. of organically managed agricultural land in Egypt 2006 – 2007



Source: **Willer *et al.*, 2008**

SWOT analysis of organic agriculture in Egypt:

Based on interviews with the producers within the study sample and the guidance of previous researches, the strengths, opportunities, weaknesses and threats of Egyptian organic agriculture can be summarized as follows:

Strengths:

- Availability of organic production inputs such as compost and bio pest control products.
- The positive economic, social, and environmental impacts of organic agricultural.
- High profitability of organic production.
- Maintaining human health and protecting from the fatal impacts of using chemicals fertilizers and pesticides.
- Organic agriculture maintains and increases soil enrichment and biological activity.
- Cheap labor force leads to less cost and more profit.

Weaknesses:

- Lack of specialized labor required to handle the organic agriculture system.
- Absence of market information.
- Low production during the transition period.
- High local prices of organic foods and drinks.
- Lack of effective knowledge transfer process due to defused role of agricultural extension in supporting the movement towards organic agricultural.
- Lack of market research studies for potential target markets for Egypt organic products.
- Domination of small-scale farms and the living style of farmers that depends on consuming the farms' production.

Opportunities:

- The great global interest of organic food and drinks leads to an increasing demand for organic foods and drinks especially in the developed countries. The increasing demand for organic products leads to more interest in growing organic products in Egypt.
- An increasing demand for Egyptian organic H&S, Vegetables, and Fruits rather than other countries' products.
- The warm weather in Egypt allows producers to have a special time window for Egypt organic products.
- Laws and regulations in Egypt that encourage the exportation of food and agricultural products in general and, in particular, organic products.
- Low barriers to trade allow Egyptian producers to reach international markets easily.

Threats

- High competition that facing Egyptian organic products generated from too many countries entering the global market of organic products.

- Low production costs of organic products grown in competing countries such as African countries and Latin countries due to low labor costs.

Overview of organic agriculture in Fayoum:

The interest of organic agriculture in Fayoum has started several years ago. However the research interest of it has started in the late ninetieth of the last century. In a study about the possibilities of organic agriculture in Egypt (**Siam *et al.*, 1999**), the study has shown a comparison between the crop budgets of some organically grown crops comparing to the same products but conventionally grown. Unfortunately the result was that organic crops are more profitable although they achieve lower productivity due to the high prices of the organic production which were mainly grown for the export market.

The same result has been confirmed in 2001 by another study on the impact of using modern technologies including organic agriculture on the Egyptian trade balance (**Sadek, 2001**).

3. Results

Balance sheet and ANOVA for chamomile:

The balance sheet for chamomile as shown in table (2) shows that organic fertilizers and compost represent the most important production input for organic chamomile. The results, also, show that there is a significant difference between the means of the costs of organic fertilizers & compost. The productivity of conventional and organic chamomile has shown no significance between means, however, the net revenue and the return on the invested pound have shown a significant difference between means.

Table (2): Balance sheet of chamomile production using both organic and conventional agriculture technique

Items	Conventional		Organic		T test
	Q	V	Q	V	
Seeds	22	104	24	113	1.29
Chemical fertilizer (Kg)	525	600	-	-	-
Organic fertilizers / compost /(m^3)	30	380	13	770	6.02 **
Pesticides	-	-	4	25	-
Total costs of production inputs	-	1094	-	899	1.13
Total costs of labor	-	2181	-	2265	1.04
Rent	-	1000	-	1000	-
Average total costs	-	4274	-	4173	1.85
Average productivity per feddan (in tons)	2.1	5250	2.24	5500	0.80
Average net revenue at farm-gate prices	-	976	-	1327	2.22 *
Average net revenue at export prices	-	2926	-	5427	3.17 **
The return on the invested pound at farm-gate prices (net revenue / total cost)	-	0.23	-	0.32	1.43
The return on the invested pound at export prices (net revenue / total cost)	-	0.68	-	1.30	3.57 **

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

The ANOVA as shown in table (3) shows a significant difference within the group of experience which concerned with the years of experience. It, also, shows a significant difference between the growing method and the area cultivated.

Table (3): ANOVA for the average productivity of chamomile using both organic and conventional

	Sum squares	Degrees of freedom	Average sum squares	F
Within growing method	1.43	1	1.43	1.07
Within years of experience	1.35	2	0.68	0.50
Within area cultivated	25.95	2	12.98	9.68 **
Between years of experience and growing method	3.50	2	1.75	1.31
Between growing method and area cultivated	2.89	2	1.45	1.08
Between area cultivated and years of experience	12.52	4	3.13	2.33 *
Error	5.35	4	1.34	

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

Balance sheet and ANOVA for spearmint:

The balance sheet for spearmint as shown in table (4) shows that organic fertilizers and compost represent the most important production input for organic spearmint. The results, also, show that there's a significant difference between the means of the costs of organic fertilizers & compost. The productivity of conventional and organic spearmint has shown a very significant difference. The net

revenue and return on the invested pound at export prices have been shown to be significantly different.

Table (4): Balance sheet of spearmint production using both organic and conventional agriculture technique

Items	Conventional		Organic		T test
	Q	V	Q	V	
Seeds	2	550	2	580	1.38
Chemical fertilizer (Kg)	675	745			-
Organic fertilizers / compost /(m^3)	33	400	13	780	5.32 **
Pesticides	7	100	5.5	40	-
Total costs of production inputs	-	1795	-	1400	1.11
Total costs of labor	-	2045	-	1570	1.24
Rent	-	1000	-	1000	-
Average total costs	-	4840	-	3970	1.76
Average productivity per feddan (in tons)	2	8000	1	6600	2.65 **
Average net revenue at farm-gate prices	-	3140	-	2630	1.24
Average net revenue at export prices	-	3435	-	3330	2.43 *
The return on the invested pound at farm-gate prices (net revenue / total cost)	-	0.43	-	0.52	1.92
The return on the invested pound at export prices (net revenue / total cost)	-	0.75	-	0.91	3.37 **

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

The ANOVA as shown in table (5) shows a significant difference within all the groups. It's, also, shown that there are significant differences between groups except in the case of years of experience and growing method.

Table (5): ANOVA for the average productivity of spearmint using both organic and conventional

	Sum squares	Degrees of freedom	Average sum squares	F
Within growing method	5.37	1	5.37	9.42 **
Within years of experience	8.77	2	4.39	7.69 **
Within area cultivated	8.92	2	4.46	7.82 **
Between years of experience and growing method	2.89	2	1.45	2.36 *
Between growing method and area cultivated	2.26	2	1.13	1.98
Between area cultivated and years of experience	24.56	4	6.14	10.77 **
Error	2.27	4	0.57	

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

Balance sheet and ANOVA for green beans:

The balance sheet for green beans as shown in table (6) shows that organic fertilizers and compost represent the most important production input for organic green beans. The results, also, show that there are significant differences between the means of the costs of organic fertilizers & compost. The productivity of conventional and organic chamomile has shown no significant differences. However, when using export prices; the net revenue and return on the invested pound have been shown as significantly different.

Table (6): Balance sheet of green beans production using both organic and conventional agriculture technique

Items	Conventional		Organic		T test
	Q	V	Q	V	
Seeds	15	215	16	230	1.20
Chemical fertilizer (Kg)	385	460			-
Organic fertilizers / compost /(m^3)	10	125	19	1145	8.12 **
Pesticides	2.5	75	4.5	35	-
Total costs of production inputs	-	875	-	1335	2.33 *
Total costs of labor	-	1270	-	870	1.27
Rent	-	1500	-	1500	-
Average total costs	-	3605	-	3405	1.55
Average productivity per feddan (in tons)	4	4900	3.4	5187	1.65
Average net revenue at farm-gate prices	-	1295	-	1282	1.24
Average net revenue at export prices	-	3860	-	5597	2.84 **
The return on the invested pound at farm-gate prices (net revenue / tota cost)	-	0.40	-	0.44	1.21
The return on the invested pound at export prices (net revenue / total cost)	-	1.13	-	1.55	2.29 *

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

The ANOVA as shown in table (7) shows a significant difference within all the groups except in the case of growing method. It's, also, shown that there are significant differences between all the groups.

Table (7): ANOVA for the average productivity of green beans using both organic and conventional

	Sum squares	Degrees of freedom	Average sum squares	F
Within growing method	2.23	1	2.23	1.87
Within years of experience	15.56	2	7.78	14.54 **
Within area cultivated	4.66	2	2.33	4.35 **
Between years of experience and growing method	5.68	2	2.84	5.30 **
Between growing method and area cultivated	2.94	2	1.47	2.75 *
Between area cultivated and years of experience	4.76	4	1.19	2.22 *
Error	2.14	4	0.54	

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

Balance sheet and ANOVA for onions:

The balance sheet for green beans as shown in table (8) shows that organic fertilizers and compost represent the most important production input for organic chamomile. The results, also, show that there's a very significant difference between the means of the costs of organic fertilizers & compost. It's, also, shown that the costs of production inputs and labor costs are significantly different in the two methods. The productivity of conventional and organic green beans has shown no significant difference. The net revenue and return on the invested pound at export prices have been shown to be very significantly different. The net revenue and return on the invested pound at farm-gate prices have been shown to be smaller in the organic agriculture methods.

Table (8): Balance sheet of onions production using both organic and conventional agriculture technique

Items	Conventional		Organic		T test
	Q	V	Q	V	
Seeds	6.5	135	4.8	135	1.18
Chemical fertilizer (Kg)	625	355			-
Organic fertilizers / compost /(m^3)	20	300	20	1250	7.22 **
Pesticides	350	120	3	45	-
Total costs of production inputs	-	910	-	1430	2.11 *
Total costs of labor	-	1040	-	1290	1.99 *
Rent	-	750	-	750	-
Average total costs	-	2950	-	3220	1.55
Average productivity per feddan (in tons)	12	5500	10	5000	1.73
Average net revenue at farm-gate prices	-	2550	-	1780	1.44
Average net revenue at export prices	-	5450	-	12277	3.97 **
The return on the invested pound at farm-gate prices (net revenue / total cost)	-	0.86	-	0.5	1.43
The return on the invested pound at export prices (net revenue / total cost)	-	1.85	-	3.8	3.87 **

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

The ANOVA as shown in table (9) shows a significant difference within all the groups except in the case of growing method. It's, also, shown that there are significant differences between groups except in the case of years of experience and growing method.

Table (9): Analysis of Variance for the average productivity of onions using both organic and conventional

	Sum squares	Degrees of freedom	Average sum squares	F
Within growing method	3.29	1	3.29	0.86
Within years of experience	9.38	2	4.69	7.39 **
Within area cultivated	14.25	2	7.13	11.22 **
Between years of experience and growing method	3.27	2	1.64	2.57 *
Between growing method and area cultivated	2.33	2	1.17	1.83
Between area cultivated and years of experience	15.35	4	3.84	6.05 **
Error	2.54	4	0.64	

Source: calculated from the study sample questionnaires. * Significant at 0.05 and ** significant at 0.01

4. Discussion:

Organic fertilizers and compost are shown to be the most important item of the production input costs, and the T test for comparing means has shown a very significant difference between the two growing methods in all cases. This result is logically acceptable based on the fact that the use of organic fertilizers and compost in organic agriculture is one of the main characteristics of such kind of production.

The costs of production inputs and costs of labor appear the same in chamomile and spearmint as H&S are common in the areas of the study sample and always be produced whether as a safe production or organic, the treatments of the two methods are almost the same and the skills of the personnel are the same. On the other hand, in the cases of green beans and onions there is a significant difference with regard to the costs of production inputs and labor costs. The interpretation of such conflict might be addressed as the production of green beans and onions require higher quantities of compost which is very expensive and, also, require skilled and expensive labor as both organic green beans and onions are relatively new products.

The productivity per feddan has shown to be lower in the organic production in all cases except in the case of chamomile where the normal production is following the roles of the safe production which means a very similar treatments, as a result the T test for comparing means has shown no difference in the two methods of production except in the case of spearmint.

The net revenue is shown to be higher in the conventional production when using the farm gate prices and with no significance except in the case of chamomile which shows a significant difference in the net revenue based on the farm gate prices. When using the export prices; all cases are shown to achieve higher revenues in the organic method except in spearmint. The reason for such conflict is that organic products are mainly targeting international markets which offer high prices for such products.

The return on the invested pound is shown to be higher in the organic production methods in all cases except in the case of onions. The T test shows a very significant difference between the return on the invested pound in each method. This result approves the need for higher investments when adopting organic production.

As for the ANOVA; the results show that there is non significant difference in the average production within all the groups. Such chamomile as a traditional product and already widely produced safely. The only exception of such result is spearmint as a heavy insect injuries product.

As for the differences in the average production between groups; it's shown that there are significant differences in most of the cases which mean that productivity increases when using the organic method with more years of experience, when growing big areas organically, and when growing big areas with more years of experience. The same result has been confirmed in 2006 by another study on the impact of using bio-farming system including organic agriculture on the production of tomatoes in Egypt (**Sadek, *et al.*, 2006**).

Recommendations:

To achieve a great success in enhancing the implementation of organic agriculture, producers must be internationally oriented since the organic production is more profitable when going abroad. It's, also, recommended to practice the organic techniques and grow big areas as the years of experience and big areas make difference in the production. To ensure the success of applying the organic agriculture in Egypt, it requires the development of integrated pest management, and the improvement of the bio-pesticides' using.

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8-12-2011