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LABOR REQUIREMENTS AND PROFITABILITY OF CHAMOMILE (*Matricaria chamomilla* L.) IN Egypt

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ABSTRACT

A comparative study has been conducted in the Fayoum governorate, where over 70% of the Egyptian chamomile is produced, during the months August 2010 - May 2011, to assess the technologies, the labor requirement and the economic results of conventional and organic producers. For this purpose, the case study approach has been chosen, and very detailed data collection has taken place in five organic and five conventional farms, selected for their structural similarity. Both types of management require very much labor, mostly supplied by external workers. The physical output per feddan is higher on conventional farms than on organic ones, but the latter enjoy premium prices that ensure a better gross margin and a higher profit. Further research is suggested, concerning water use, partial mechanization of the flower collection and the establishment of producers' associations.

Keywords: chamomile, labor requirement, organic agriculture, cost of production, fayoum oasis.

INTRODUCTION

The main objectives of this study were a) to compare the farm management and economic aspects of the conventional and organic chamomile production in the Fayoum governorate (Egypt) and b) to assess and compare the profitability of the two systems.

Comparative studies (Lampkin, 2004) of organic versus conventional systems are frequently used by researchers to establish the differences between the two systems in terms of yields and productions costs, as well as other aspects, like impacts on biodiversity, energy consumption, water demand and labor requirements. Some studies focus only on one crop, while other ones investigate entire systems. Some studies have lasted one year, whereas other ones have covered several years, to consider the effects of climate and market fluctuations. Such studies are also useful to determine the level of subsidies for organic farmers, as in the European Union and other neighboring countries.

In this research, only chamomile is investigated, within the paradigm of conventional economics (Kahan, 2004), i.e. without considering any externality, but within the broader perspective of the whole farming system and the data refer only to the growing season 2010-2011.

Organic agriculture (OA) originated in 1926, when Rudolph Steiner, founder of anthroposophy, delivered six lectures to a group of farmers and cattle breeders about his vision for agriculture in Eastern Prussia, now part of Poland, but only recently a definition has been formalized. For the FAO-WHO Codex Alimentarius, "OA is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system". More recently, the International Federation of Organic Agriculture Movements (IFOAM), an umbrella organization with almost 800 affiliate non governmental organizations, has issued the following definition: "OA 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. OA combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved". In 2009, OA was practiced by almost 1.8 million producers, over 37 million hectares of agricultural land, in 160 countries and generated a world market of about 40 billion euros, or 52 billion US dollars (Willer and Kircher, 2011).

LITERATURE REVIEW

German chamomile (*Matricaria chamomilla L.*) is an annual plant native to Southern and Western Europe, and to North and West Asia. The word chamomile derives from the Greek: *chamos* (ground) and *melos* (apple), referring to the fact that the plant grows low to the ground, and the fresh blooms have a pleasing apple scent (Gardiner, 1999). In ancient Egypt chamomile had a religious use and was consecrated to the god of the sun.

Dried chamomile flower is a medicinal drug well known since ancient Egypt, Greece and Rome. Chamomile is one of the most popular and documented herbal medicines. It is used externally for wounds, ulcers, eczema, skin irritations, neuralgia, sciatica, rheumatic pain, hemorrhoids, mastitis, and leg ulcers, diaper rash, cracked nipples, chicken pox, poison ivy and conjunctivitis, and as a hair tint and conditioner (Salamon, Ghanavati and Khazei, 2010). Chamomile is also very much consumed as a tea or tonic to treat anxiety, hysteria, nightmares, insomnia and other sleep problems, convulsions and even delirium tremens (Gardiner, 1999).

Chamomile is nowadays grown commercially in Europe and the former USSR (Belarus, Ukraine, Moldova, etc.), in North Africa (Egypt, Ethiopia), in Asia (Turkey, Afghanistan, Pakistan, North India, and Japan), in America (East Coast of the USA, Cuba, Argentina, and Brazil) and in Australia and New Zealand.

In Egypt, according to the Ministry of Agriculture and Land Reclamation, in 2009 the total area of chamomile was 4,916 ha, or 13% of the total area with medicinal and aromatic plants; 77% of chamomile was in the Fayoum governorate.

Table 1. Area, yield and production of chamomile in Egypt (2009).

Governorate	Area		Yield	Production	
	(ha)	%	(t/ha)	(t)	%
Lower Egypt	14	0.3	0.95	13	0.1
Beni Suef (Middle Egypt)	1, 052	21.4	1.78	1, 875	19.3
Fayoum (Middle Egypt)	3, 795	77.2	2.04	7, 733	80.2
Assuit (Upper Egypt)	52	1.1	1.40	72	0.7
Outside of the Nile valley	3	0.1	2.34	7	0.1
Total	4, 916	100.0	1.97	9, 701	100.0

Source: Ministry of Agriculture and Land Reclamation, 2010

In the period 2003-2005, Egyptian annual exports of chamomile were about 6,000 tons, while local consumption reached 500 tons of flowers and its by-products. The next two major competitors are Argentina and the aggregated countries of Eastern Europe, with a market share of around 20% each (IMC, 2005). Germany is the most important destination market, with about 40%, followed by Spain, America and Italy, with a relative importance estimated at 15.2%, 7.9%, and 7%, respectively (El-Shrief *et al*., 2009). First grade chamomile gets the highest prices and is mainly exported. Lower grades and the powder resulting from processing are sold domestically.

About 20% of chamomile in Egypt is nowadays organic. In 2009, the total organic chamomile area was estimated at 2,192 ha, which accounts for 45% of the total organic area with medicinal and aromatic plants. Organic chamomile covered 1,932 ha in the Fayoum governorate, meaning 52% of total organic MAPs area in this governorate. Also conventional farmers are conscious that chemicals and pesticides must be used carefully or totally abandoned, because exporters have established high quality standards and the presence of residues may eliminate any chance of foreign markets.

Modern OA started in Egypt in 1977 (El-Araby, 2004) on a farm of about 17 hectares owned by the SEKEM company, in the Eastern desert, to produce medicinal herbs for the export market. This firm was established by Dr. Ibrahim Abouleish, who had spent 19 years in Austria. He decided to initiate a project of cultural renewal based on a synthesis of Islam and anthroposophy. The first large economic activity was the production of a medicinal compound, ammoidin, an extract of *Ammi majus L.* (Lace flower). The manufacture of herbal teas and a company to market fresh biodynamic produce followed. The needs of these companies have motivated many farmers throughout Egypt to convert to biodynamic methods, supported by an advisory service established by SEKEM itself. In 1990, SEKEM founded the Centre of Organic Agriculture in Egypt, an independent organization that inspects organic farms in Egypt, Iran and Sudan.

Expansion of OA has been slow until 1988. Then a rapid growth occurred mainly in the Fayum and Kalubia governorates in the production of vegetables, fruits, cereals and cotton. In 1994, a group of producers established the Union of Growers and Exporters of Organic and Bio-dynamic Agriculture. In 1998, an important project was started in the Sinai, to preserve the purity of the land and of the environment. Nowadays the Al Hoda organic farm extends over 300 hectares, due to the market demand for organic fruits and vegetables. In the meantime, some organic firms like Ever Green Egypt, Sonak, Sultan Farm, Fayum Society of Small Organic Farmers and others have initiated their activities.

In 2006 (Kledal *et al.*, 2008) there were about 190 firms and 600 organic farms in Egypt with a total area of about 59,000 hectares, representing about 1.7% of the total cultivated area of the country. More than half of the organic farms are of small and medium size, with only a few very large farms. Due to climate conditions and availability of water in the cultivation areas, crops are harvested all year round. Some crops are typical for winter, like cucumbers, onions, various herbs and fodder, including alfalfa. The primary summer crops are grapes, baby corn, peas and cotton. Potatoes and tomatoes are typically grown throughout the year.

In 2008 the Ministry of Agriculture and Land Reclamation issued the decrees no. 1,411 and 1,412 to regulate and develop organic agriculture, followed in 2010 by the Ministry of Trade and Industry with the decree no. 993 to regulate processing and marketing of organic goods. Farmers and processors must be certified by

certification bodies registered with the Egyptian Organization for Standardization and Quality (EOSQ).

About half of organic produce is exported, with the major markets being the EU, USA, Canada, Australia and Japan. Egyptian produces can also be found in the Gulf Emirates. The most important herbs are chamomile, coriander, dill, lemongrass, hibiscus, marjoram, parsley, peppermint, and spearmint. The most relevant vegetables are potatoes, onions, garlic, green beans, peppers, and peas. The fruits for export are citrus, mangos, grapes, and olives. Egyptian organic exports benefit from the off-season supply to the European market.

Domestic organic sales are concentrated in the urban areas of Cairo and Alexandria. Outlets in high-income areas with a presence of affluent foreigners account for much of the market. Shopkeepers estimate that 60 to 70% of the consumers are foreigners. Many pharmacies in Egypt sell organic medicinal plants, essential oils and teas. A number of supermarket chains (Metro, Carrefour and others) have organic sections and sell fruits and vegetables.

MATERIALS AND METHODS

The study has been conducted in the Fayoum governorate, where over 70% of the Egyptian chamomile is produced (Tutwiler *et al*., 2005). Fayoum is a natural oasis in the Western Desert at about 90 km from Cairo, connected with the Nile through the Bahr Yusuf canal, which flows into Karun Lake. The soil type is clay soil to clay mud to solid high hardness, with the presence of sand with some limestone. The governorate is divided into five districts, with five cities and 159 villages. Annual temperatures are between 29.6°C and 14.5°C;, relative humidity 51%, rate of evaporation 4.7 mm/d, annual rainfall almost nil. Agriculture totally depends on the irrigation water from the Nile. Similar climates can be found in the southern regions of the United States of America and in southern Mexico, Australia, China and northern India (Ahmed, 2008). The Fayoum total area is 189,553 ha, out of which 176,557 ha are cultivable. The rural population is more than twice the urban population and the majority of the labor force is involved in agriculture, with the winter crops of wheat, beans, onions and garlic and the summer crops of cotton, tomatoes, corn and olives (Abd El-Warith and CDM international inc., 2007). Other products include mango, orange, grapes, and aromatic medical plants.

The case study approach has been chosen (Yin, 2009) to favor a detailed and in depth knowledge of the organic production process. After contacts with the local Department of Agriculture, the certification bodies and several chamomile growers, a group of ten farms has been selected, consisting of two sub-groups of five farms each: one representative of the small conventional producers and the other one representative of the organic growers. Organic and conventional farms were selected to meet the following requirements: a) similar environmental conditions (land fertility, climate); same localization; same equipment of production factors; same business typology (farm type). Organic farms had to: (i) have a history of at least three years under organic management and (ii) be subject to an active management using organic principles. The conventional farms were selected primarily for proximity to their respective organic counterparts and for the similarity of agricultural practices and area under chamomile.

All organic farms have the same size (4.88 feddans) because this land was distributed by the government in the 1980s to young graduates. Other crops in these farms include onion, fennel, and anise beside wheat, broad beans and alfalfa.

All small farmers market the chamomile as green flowers and they do not access to foreign or local markets directly, but sell at farm gate price their output to specialized private companies. All farmers hire permanent and seasonal workers. The irrigation system is traditional, with water pumped from the canals and then distributed over the fields. Mechanization is limited to soil preparation.

A questionnaire has been designed to collect two types of data: (i) general characteristics of the selected farms (location, total area, rotation, chamomile area, family composition, buildings and machinery, etc.) and (ii) technical and economic data (nursery and open field operations, inputs use, time requirements, prices, yields, marketing channel, etc.). The questionnaire was initially tested by visiting a few farmers and after their advice this research tool has been modified, tested again and then implemented.

Table 2. Structural data of the selected farms.

Farm	Total area	Chamomile	Cham / Total	Farm	Total area	Chamomile	Cham / Total
	Fed	Fed	%		Fed	Fed	%
OF1	4.88	2.33	47.6	CF1	3.02	1.00	33.1
OF2	4.88	3.02	61.9	CF2	19.77	1.00	5.1
OF3	4.88	3.02	61.9	CF3	3.95	1.00	25.3
OF4	4.88	2.33	47.6	CF4	4.88	1.23	25.2
OF5	4.88	2.33	47.6	CF5	14.65	3.02	20.6

Data were collected for about eight-months, starting by mid September 2010, when sowing seeds begins in the nursery, to May 2011, when the chamomile growing season ends. Each farm was visited several times, to check the progress of the crop and to meet the farmer. Data were treated with a specific Microsoft Excel data sheets model, which automatically calculates the results of each individual farm, the average of each subgroup, the compounded average for the organic farms and conventional ones, the performance ratios and then compares all results.

The variable costs are quantified by taking into account all the production costs, from the nursery preparation to the removal of the plants at the end of the season. The variable costs refer to the seedlings' production, where the case, land preparation, transplanting, irrigation, weed and pest control, harvesting. A 7% interest rate has been applied on the working capital, with an average anticipation of four months.

The fixed costs, by definition, are those costs which do not vary with the level of production and which are supported by the farmers also at production zero. To elaborate the full cost of production, the following items have been considered: the land charge, as the cost of using the land for eight months, the cost of certification for the organic farmers, some miscellaneous costs for the functioning of the farm (telephone and mail bills, travels to town, electricity) as 5% of the land charge, and the interest calculated as before for the variable costs.

All costs are calculated in Egyptian Pounds (EP) and for one feddan (Fed), the Egyptian area unit = 0.43 hectares.

Finally, several indicators have been elaborated to compare conventional and organic farms, individually and as groups.

The gross margin is the most used short term tool for evaluating the performance of a given enterprise. It belongs to the partial budgeting instruments, because it does not take into account the complexity of the whole farm and the relationships between different crops and animal productions. The formula used to calculate the gross margin for each farm has been the following one:

- Gross margin = Total value of output - Variable costs

The profit per feddan has been calculated with the following formula:

- Profit = Total value of output - (Variable costs + Fixed costs)

For evaluating the chamomile performance, four ratios have been calculated as follows:

- Profitability: Profit / total costs =
- Break-even yield = (Total costs - value of byproducts) / main product price
- Break-even price = (Total costs - value of byproducts) / yield of main product
- Return per day of family labor = (Profit + calculated value of family labor) / days of family labor.

RESULTS AND DISCUSSIONS

The study confirms that chamomile demands a great quantity of human labor (Table-3): 816 hours per feddan in the conventional management and 877 in the organic farms. An unexpected result concerns the relatively small amount of labor provided in both subgroups by family members.

Table 3. Labour requirements for one feddan of chamomile.

Activity	CF				OF				OF/CF
	Hired	Fam	Total		Hired	Fam	Total		
	h	h	h	%	h	h	h	%	%
Soil preparation	9	1	10	1.2	8	3	11	1.3	10.0
Digging sub-canals	4	5	9	1.1	6	4	10	1.1	11.1
Fertilization	41	11	52	6.4	28	6	34	3.9	-34.6
Pest and disease control	9	0	9	1.1	10	1	11	1.3	22.2
Weed control	44	19	63	7.7	51	13	64	7.3	1.6
Transplanting	15	5	20	2.5	18	7	25	2.9	25.0
Irrigation	0	15	15	1.8	0	15	15	1.7	0.0
Flower collection	627	0	627	76.8	642	0	642	73.2	2.4
Removal of plants	6	1	7	0.9	35	5	40	4.6	471.4
Mgmt and supervision	0	4	4	0.5	0	25	25	2.9	525.0
Total	755	61	816	100.0	798	79	877	100.0	7.5
Total %	92.5	7.5	100.0		90.1	8.9	100.0		

Most labor is actually provided by hired laborers: 92.5% in the first group and 90.1% in the second one. The collection of flowers, spread over several weeks, absorbs almost three fourths of the total labor, followed by weed control (7.7% and 7.3% respectively in CF and OF). When comparing organic management with the conventional one, OF demands a higher quantity of labor (+7.5%) due to some differences in all phases of the cultivation. A negative difference is registered for the fertilization, whereas great difference exists, in relative terms, for the removal of plants and for the management and supervision. Organic farmers affirm that they must spend longer time in the fields, to be sure that the workers respect their guidelines.

The chamomile production per feddan (Table-4) is 7.9% lower in the OF system, but this minor physical output is counterbalanced by a much higher price for the flowers (+30%) and for the stems (+70%). Thanks to these premium prices, the average total output value of the organic farmers is quite satisfactory: 20% higher than the value recorded in the conventional farms. Similar results have been found by El-Shmawy and Ali (2010) and by Sadek and Shelaby (2011).

Table 4. Chamomile output. per feddan.

Items	Unit	CF	OF	OF/CF
				%
Fresh flowers	kg	4, 183	3, 854	-7.9
Price per kg	EP	3.0	3.9	30.0
Main product value	EP	12, 549	15, 031	19.8
Byproduct - stems	kg	908	748	17.6
Price per kg	EP	0.50	0.85	70.0
Byproduct value	EP	454	636	40.0
Total output value	EP	13, 003	15, 666	20.5

Fixed costs (Table 5) represent 22.7% of the total cost of production in the case of conventional farming, and 24.7% in the case of organic production. Organic farmers face heavier expenditures, because they cultivate soils of higher value and have to pay the costs of certification and the membership in organic NGOs. Also the calculated costs due to various fixed expenditures and the interests on fixed capital are consequently higher.

Similarly, organic farmers have higher variable costs (Table 5), because the organic fertilizers are much more expensive, the production or purchase of seedlings is more costly, as well as the compounds for pest and disease control. Only for machinery and hired workers we find that the conventional farmers have more expenses than the organic producers.

Table 5. Structure of costs for the production of chamomile (EP/fed).

Fixed costs	CF		OF		OF/CF
	EP	%	EP	%	%
Land charge	1,666	21.1	2,000	22.4	20.0
NGO membership fee			25	0.3	
Certification fee			30	0.3	
Miscellaneous farm management	86	1.1	100	1.1	16.3
Interest on fixed capital	41	0.5	50	0.6	22.0
Sub - total fixed costs	1,793	22.7	2, 205	24.7	23.0

Variable costs					
Fertilizers	1,096	13.9	1,732	19.4	58.0
Seedlings	228	2.9	262	2.9	14.9
Pests and diseases control compounds	79	1.0	83	0.9	5.1
Hired workers	3,788	48.0	3,823	42.8	0.9
Family workers	285	3.6	269	3.0	-5.6
Machinery	464	5.9	372	4.2	19.8
Management and supervision	18	0.2	25	0.3	38.9
Interest on anticipation	139	1.8	153	1.7	10.1
Sub - total variable costs	6,097	77.3	6,719	75.3	10.2
Total costs	7,890	100.0	8,924	100.0	13.1

Summing up variable and fixed costs, the organic management of one feddan of organic chamomile is 13% more expensive than the conventional way of production. Fortunately, the organic output value is much higher than in the conventional system and consequently the first production model shows (Table 6) a very positive gross margin and a very good profit. In the organic system, one feddan of chamomile is 32.7% more profitable than the conventional production. The profit/costs ratio is almost the same, as well as the calculated return to one day of family labor. At this technological level, the organic farmers can reach the break even yield quite earlier than the conventional ones (2,125 kg vs. 2,479 or -14.3%), but the organic producers need a much higher price (2.15 EP vs. 1.78 or +20.8%).

CONCLUSIONS

This research, although limited to one year, confirms that organic agricultural systems can be profitable, even without the subsidies, as the ones given to producers in the European Union, if the farmers achieve relatively good yields and the output receives a premium price. More applied research is consequently needed to improve the technical results. Several aspects, which were not illustrated in detail in this paper, could be improved: the cost of organic fertilizers, the quality and effectiveness of the compounds used against diseases, the effectiveness of the biological control of insects, etc.

Another interesting aspect is the - at least partial - mechanization of some operations. At present, the cost of labor in Egypt is very low and unemployment in rural areas is very high. There is no urgent need to mechanize the various operations, but research could be activated, to initiate the search for labor saving, simple devices, that could increase labor productivity.

A relevant issue will be irrigation, because the water is presently used without any form of payment and is distributed according to traditional rules. This could slowly change and water saving approaches, based on modern technologies and different farming systems, could become necessary.

All organic producers sell fresh flowers to processors, who then market the produces under different methods and with different channels. The added value of this part of the value chain is completely out of the hands of the producers.

Table 6. Economic results of chamomile.

Items	**Unit**	**CF**	**OF**	**OF/CF**
				%
Gross margin	EP/Fed	6,893	8,940	29.7
Profit	EP/Fed	5,100	6,735	32.1
Profit/costs ratio		0.74	0.75	1.8
Break-even yield	kg/Fed	2,479	2,125	-14.3
Break-even price	EP/kg	1.78	2.15	20.8
Return to family labour	EP/d	713	714	0.1

Nowadays this is not a problem, but the prices could fall and the premium price could become much thinner. Another option to explore is consequently the establishment of cooperatives, or other forms of aggregation, to maintain the control over the post gate phases of the value chain. This decision would require

investments, training, educated management, marketing strategies, technical and financial assistance by donors, and must be carefully studied.

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