A Comparative Cost Analysis of Organic and Conventional Cotton Production in Viotia - Greece

C. Fotopoulos[1] and C.J. Pantzios [2]

[1]Director - Principal Researcher, Agricultural Economics and Social Research Institute, National Agricultural Research Foundation - Greece.

[2] Researcher, Agricultural Economics and Social Research Institute, National Agricultural Research Foundation - Greece.

ABSTRACT

Cotton growing in Greece has been drastically affected by E.U. policies, oversupply and declining prices. Cotton cultivation also ranks high in the list of heavily polluting crops. The perspectives of liberalized world agricultural markets and the danger of declining soil fertility make alternative cotton cultivation techniques a timely and interesting topic. Although organic cotton growing offers an option that addresses these considerations, its economic performance remains, largely, an empirical question. The present study attempts such a comparative economic evaluation of organic and conventional cotton production, using a local sample of cotton operations in Continental Greece. Its findings suggest that organic cotton costs are not considerably lower than conventional costs while significantly lower yields and lack of high price premiums result in lagging economic performance.

Introduction

Cotton growing has been one of the most dynamic agricultural enterprises in Greece, characterized by high output value, high farm income and compelling exporting performance. Since the mid 1990s however, cotton farming in Greece has slipped into a worrying recession triggered by record-high levels of domestic supply and a drastic tightening in the respective EU support policies.

With much of the agricultural sector faced with similar recession (characterized by declining prices, and reduction of support policies), exclusive reliance on conventional policies (e.g., price support schemes) is no longer possible. Alternative strategies are urgently needed to support the viability of agricultural enterprises and develop new forms of farming activities. Prominent among such alternative strategies is the idea of introducing the concept of differentiation among varieties of agricultural products on the basis of their quality characteristics. A standard case of such differentiation is the use of environment-friendly (or 'organic') techniques in agricultural production.

Organically produced commodities can be distinctly differentiated from their conventionally produced counterparts. This is because the EU has already introduced a specialized institutional framework (E.U. Reg.2092/91 and E.U.Reg. 2078/92) which allows certification through inspecting organizations of commodities such as 'organic' (the terms 'ecological' or 'biological' are also used). Although the use of organic farming techniques is a conceptually attractive alternative, in practice, the actual economic performance of organic agricultural enterprises remains, largely, an empirical question.

In this framework, the objective of this study is to attempt a comparative economic evaluation of organic vs. conventional cotton production. Admittedly, both the locality and size of the data sample limits the inferences from the results. However, the study constitutes a pioneer attempt of evaluating economic performance in an area of farm activities where the empirical investigation of *a priori* beliefs is absent. The rest of the paper is organized to provide a brief outline of the current state of conventional and organic cotton growing in Greece in Section 2 with the data and a comparative analysis of the costs incurred in organic and conventional cotton growing techniques in section 3. Concluding remarks are offered in the final section.

Conventional and Organic Cotton Production in Greece

Cotton growing has shown an impressive expansion in Greece during the last two decades. The sector's rapid enlargement has been mainly the result of the early high support mechanisms of the Common Agricultural Policy (CAP) of the EU, as well as the decline (especially in the beginning of the 1990s) of the prices of substitute crops, such as maize.

The acreage cultivated with cotton doubled during the decade 1981-1991 reaching 2.4 million stremmas (24,000 ha) in the period 1991 from only 1.2 million stremmas (120,000 ha) in 1981. During the next five years, cotton growing acreage almost doubled again reaching 4.27 million stremmas (42,700 ha) in the period 1996. At the same time, the volume of production has tripled: from only 290,000 tons in 1981, it swelled to about 1 million tons in 1996 (Greek Cotton Board).

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Greek cotton growers have also achieved considerably high yields: the country ranks fifth at world level, in terms of cotton yields (Avgoulas and Koutrou-Avgoula, 1997). Within the EU, Greece is the largest cotton producer, contributing about 70% of the total EU cotton production. Geographically, the cultivation of cotton is located in the areas of Thessaly, Macedonia, and Thrace and involves more than 100,000 agricultural operations.

However, the high expenditure of the early EU support policies on cotton production and the resulted oversupplies forced the European Commission to impose mechanisms aiming at the reduction of cotton production. Thus, besides determining institutional prices for cotton, production quotas (nicknamed Maximum Quantities Guaranteed or MQG) are currently imposed on each cotton producing country. In addition, monetary penalties (known as corresponsibility levies) are charged when a country exceeds its MQG. As a result, cotton prices have recently stopped the steady rising they exhibited in the 1980s and they even dropped. At the same time, the perspective of a (gradual) liberalization of the world agricultural markets (already initiated at the recent Uruguay Round on International Trade) is expected to put additional pressure on cotton prices within the EU.

In this rapidly changing environment (characterized by drastic reductions in price support, increasing competition and liberalization of trade flows), the quality-based differentiation of cotton becomes (as mentioned above) an appealing alternative for facing plummeting prices and surplus production. As noted earlier, production of cotton via environment-friendly, organic techniques readily qualifies as a means of such product differentiation.

In general, organic techniques totally exclude the use of chemical inputs (fertilizers and pesticides) while utilizing biological control methods for insect and weed control. Certified, organically produced cotton is used as the main input in high quality clothing (T-shirts, sweaters, infant wear, towels etc.). In principle, the differentiation of cotton via organic cultivation techniques could lead to considerable economic as well as environmental benefits.

In particular: (a) organically produced cotton and its subsequent use in specialized textile units may lead to the development of niche markets and the differentiation of its price relative to the price of conventionally produced cotton; (b) the elimination of expensive chemical inputs from cotton cultivation may lower production costs and reduce extremely high yields; (c) organic cultivation of cotton may result in quite favourable environmental effects since it is well known that conventionally cultivated cotton ranks high in the list of heavily polluting crops.

However, the application of organic techniques in cotton growing is currently facing considerable difficulties since the respective know-how (organic fertilizing, means of biological control) is incomplete or experimental. These difficulties are reflected on the minimal percentage of organically cultivated land that is devoted to cotton growing.

Organically utilized agricultural land (OUAL) in Greece reached about 52,700 stremmas (5,270 ha) in 1996 accounting for 0,15% of total agricultural land. Of the annual organic crops, cotton showed a promising start as it was grown in about 370 ha (31% of total OUAL) in 1994. It plummeted, however, to 194 ha (8% of OUAL) in 1995 and to 153.6 ha (3% of OUAL) in 1996.

Nonetheless, total acreage of fully organic cotton fields shows a steady growth rate as it tripled from 1994 to 1995 and more than doubled from 1995 to 1996. These abrupt changes underline the difficulties in organic cotton cultivation methods but also point out a core of persistent organic cotton growers. (Fotopoulos and Pantzios, 1998). Finally, it should be noted that additional financial aid has also become available to organic cotton growers via the aforementioned E.U.Reg. 2078/92 in the form of acreage-based subsidies, as is the case with almost all organic farming activities.

Economic Evaluation of Organic and Conventional Cotton Operations

The data used here belong to the database of a broader research project on the economic performance of organic farming[1]; they refer to the period 1995-96 and were collected via a questionnaire survey of 29 cotton operations using organic cultivation techniques. The sample comes from Viotia county in Continental Greece, since this was the only area where a systematic attempt to grow organic cotton was taking place at the time of the survey. A second sample consisting of neighbouring conventional cotton operations was also surveyed to provide analogous data for conventional cotton growing. The 'conventional' sample is of equal size and approximately similar characteristics to provide compatibility with the 'organic' sample.

Tables 1 through 4 present a breakdown of the main production expenses incurred in the cultivation of conventional and organic cotton, along with the respective gross revenues and production yields. Specifically, the upper part of the tables calculates the

1 The project, entitled 'The Production System of Biological Agriculture as an Alternative Solution to the Development of Greek Agriculture' belongs to the research program Dimitra'95. It is financed by the National Agricultural Research Foundation (N.AG.RE.F.) and carried out by the Agricultural Economics and Social Research Institute (AG.E.S.R.I.).

gross revenue, taking into account the average yield, the producer price and for organic cotton operations, the 'organic' subsidy. The middle part presents the composition of production costs, while the lower part calculates the respective family farm income. To facilitate comparisons, all items in the tables are given on a per stremma (0.1 ha) basis, while the percentage composition of the production cost is shown alongside the actual cost list.

For the purpose of a more detailed analysis, the sample was divided into three groups of cotton operations according to the land cultivated, namely, operations with 0 to 50 stremmas (group A), operations with 50 to 100 stremmas (group B), and operations with more than 100 stremmas (group C). Table 1 refers to the sample as a whole, while Tables 2 through 4 refer to the groups A, B, and C, respectively.

The general layout of the tables follows the standard practice used in agricultural economics accounting (Kitsopanidis and Kamenidis, 1992). The interest foregone, due to the variable production expenses are computed as the sum of cost items 2c through 11, times a short-term interest rate,[2] for six months. In computing the depreciation rates of various machinery and other capital equipment, the standard linear depreciation method is used[3]. In all examined operations no acreage was actually rented so the land rents appearing in the tables are imputed. For the same reason the family farm income is computed as the sum of gross revenues, land rent, family labour and interest on variable expenses minus total cost.

Starting the analysis with the production expenses, labour (in all its forms, i.e. family, hired and mechanical) appears to be (with the exception of land rents) the most significant component of organic cost production. For the examined sample as a whole, it represents 28% of total expenses in organic cotton cultivation compared to 20% of the total expenses, in the case of conventional cotton cultivation. Moreover, the overall cost of labour (family, hired or mechanical) per unit of land appears to be about 35% higher in organic cotton farming than in conventional cotton farming.

Turning to the groups A, B, and C of the sample, overall labour cost is 29%, 27%, and 29% of organic production costs and, 23%, 21%, and 16% of conventional production costs, respectively. Per unit of land, the difference between the cost of labour in organic and conventional cotton farming appears to be higher in group C, wherein total labour per stremma costs, on the average 57% more in organic cotton operations than in conventional ones. In group A, labour cost is 35% more expensive in organic than in conventional cotton operations. However, due to the increased cost of mechanical labour in the conventional cotton operations of group B, total labour costs appear comparable for both modes of cotton growing in this group. Nonetheless, the cost of manual (family and hired) labour per stremma appears consistently higher in organic cotton growing in all the three groups, considered.

Regarding the cost of fertilizing, the expenses on fertilizers appear 34% higher per stremma in conventional relative to organic cotton operations, for the whole sample. However, in group A, the expenses on organic fertilizers are almost equal per stremma for organic and conventional cotton operations. In group B, fertilizer cost is, on the average, 14% more expensive per stremma in conventional than in organic operations while in the large acreage operations (group C) the cost of chemical fertilizing appears, on the average, almost double relative to the cost of organic fertilizing.

Pesticides represent a respectable expense in conventional cotton operations, accounting for 4%, 4%, and, 5% of total production expenses in groups A, B, and C, respectively, and 4% for the examined sample, as a whole. Their counterparts in organic operations (various organic substances for biological control) represent virtually negligible expenses. Thus, the combined cost of chemicals (fertilizers and pesticides) is, on the average, 10% of total expenses per stremma in conventional cotton operation; the corresponding cost (organic fertilizer, substances for biological control) is, on the average, only 4% of total expenses per stremma in organic cotton operations.

An additional expense pertaining only to organic cotton growing is the cost of inspection(s) by the certifying organization that confirms a farm's cotton produce as organic. This cost appears, on the average to be about 1% (or 968 drs/stremma) of the total cost per stremma for the whole sample. It ranges however from 2% of the total cost per stremma (or 1237 drachmas/stremma) in group A to 1% of the total cost per stremma (or 271 drachmas/stremma) in group B. To the extend that the cost of inspection is standard across farms (irrespectively of their size), this cost appears higher (per unit of land) for small compared to large operations. Additionally, it should be stressed that not all organic operations of the sample reported certification expenses.

In group A, total cost of organic cotton appears, on average, 7% higher than the cost of conventional cotton. However, for farms that grow cotton in 50

2 The interest rate used here is the short term interest rate of the Agricultural Bank of Greece which for the period 1995-96 was set at 21%, annually.

3 In particular, the depreciation of a capital item is computed as its current market value, times a constant depreciation rate, time the percentage of the total utilization of this item (in hours of use) in the examined agricultural activity. Depreciation rates for the various machinery and other capital items were taken from tables published from the Ministry of Agriculture.

stremmas or more (groups B and C), the cost of producing organic cotton appears to be 23% and 14% lower than groups B and C, respectively. Inspection of the cost structure in these groups reveals that the increased cost of conventional production is primarily due to: (i) the higher land rents; (ii) the additional cost of chemical pesticides; and (iii) the higher (almost double) depreciation rates of machinery and other capital equipment. Nonetheless, despite the differences among the groups examined, overall, the cost of producing organic cotton does not appear considerably different from the production cost of conventional cotton; for the whole sample the total cost of organic cotton is only 5% lower than that of conventional cotton.

Regarding the produced output, yields are consistently much lower in organic cotton operations. The average yield is lower by 20%, 27% and, 36% in groups A, B, and C, respectively; overall, the yield of organic production appears lower by 27% when compared to the conventional cotton yield. At the same time, prices for organic cotton are not, on the average, significantly different from conventional cotton prices (although they fluctuate widely across the examined farms, ranging from 240 drs/stremma to 345 drs/stremma). The combination of significantly lower yields and lack of considerable price premiums result (in all cases) in lower revenues for organic cotton despite the additional subsidy of 9900 drs/stremma to organic cotton growers, via the E.U.Reg.2078/92. Consequently, with the exception of group B, family farm income is also lower for organic than conventional cotton operations.

Concluding Remarks

The economic performance of organic cotton production appears, in general, problematic. Except for the increased labour and reduced fertilizer, the observed differences in cost of producing organic and conventional cotton (groups B and C) are mainly due to land rents and depreciation costs. However, the stock of machinery and other capital equipment is known to vary widely across farms, yielding widely different depreciation rates. At the same time, organic cotton growing in most of the examined cases is a complementary farm activity, in contrast to conventional cotton growing which is the primary activity in conventional cotton farms.

This may partly explain the lower land rents and depreciation costs, to the extend that second-rated land and a low portion of the machinery's total use is allocated to organic cotton cultivation within the farm. In other words, the low depreciation appearing in organic cotton costs may well be attributed to the fact that the capital used in organic cultivation is jointly used to other, primary farm activities. If organic cotton growing were the primary farm activity (as is the conventional cotton cultivation), the depreciation cost of this capital equipment in total organic production costs would be much higher.

Depreciation and land rents aside, costs of 'organic' and 'conventional' cotton production appear, on the average, rather similar as the lack of pesticides in organic cotton growing is countered by increased manual labour. It follows that organic cotton cost may not expected to be significantly different from conventional production cost, in general. Thus, a priori claims of lower organic production cost due to the lower use of inputs should be considered with caution, at least at the present stage.

On the other hand, yields are considerably lower in organic cotton operations. This should be considered in combination with a virtually total absence of systematic means of biological control. The success of organic production relies mainly on the use of fertile soils, suitable varieties, and on the absence of pest diseases and weeds; Weed control especially, is carried out via increased manual labour (Galanopoulou-Sendouka, 1998).

In addition, price premiums (whenever they exist) do not seem, in general, high enough to justify organic cotton farming as an attractive economic alternative to conventional cotton farming. One should take into consideration however, the fact that the costs and revenues computed here do not account for non-monetary costs/benefits associated with conventional/organic cotton growing. Nonetheless, the evaluation of such costs/benefits is out of the scope of the present study.

Focusing on the market costs/benefits of the two examined cotton farming methods, it may be argued that organic cotton growing (at least as far as its profitability is concerned) has a rather long course ahead. Unless specific know-how is developed that addresses the problems of biological control and makes efficient combinations of production costs and yields possible, organic cotton growing will lag in economic performance. Alternatively, achievement of much higher price premiums could also improve its economic performance. The 'organic' subsidies of EU Reg.2078/92, currently in place, although narrowing the profitability gap between organic and conventional cotton growing do not seem enough to sustain an impetus in the development of organic cotton farming; systematic technical and market research may prove more crucial in the long run.

Finally, it is worth noting that the findings of the present study confirm, in general, information on the economic performance of organic cotton found elsewhere in the literature (Galanopoulou-Senduka, 1998). However, in light of the limitations of the data used here, a more comprehensive, inter-temporal evaluation of the economic performance of organic relative to conventional cotton farming is required before this mode of cotton production is broadly

recommended as an economically viable alternative technique.

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Table 1. Revenues, production costs and family farm income in organic and conventional cotton farming, Viotia-1995-96.

	Organic operations (n=29)		Conventional operations (n=29)	
1. Yield (kg/stremma)	218		300	
2. Price (drs/stremma)	296		289	
3. Value of Production (1x2)				
4. E.U.Reg.2078/92 (drs/stremma)	9900			
Gross Revenues	74428		86700	
Production Expenses	drs/str	%	drs/str	%
1. Land Rent	20333	30	24409	35
2. Labour	19123	28	14179	20
a. Family	7729		5283	
b. Hired	5873		1787	
c. Hired Mechanical	5521		7109	
3. Fertilizers	2870	4	3899	6
4. Pesticides	-	-	2959	4
5. Biological Control	113	0	-	-
6. Fuel	5809	9	5700	8
7. Power	2203	3	1995	3
8. Seeds	2571	4	3107	4
9. Irrigation	1128	2	1625	2
10. Insurance	534	1	381	1
11. Organic Certification	982	1	-	-
12. Interest on variable costs	1969	3	2091	3
13. Depreciation	9660	14	10273	15
Total Cost	67295	100	70618	100
Family Farm Income	37164		47865	

Table 2. Revenues, production costs and family farm income in organic and conventional cotton farming, Group A, Viotia-1995-96.

	Organic operations (n=15)		Conventional operations (n=10)	
1. Yield (kg/stremma)	205		245	
2. Price (drs/stremma)	296		292	
3. Value of Production (1x2)			-	
4. E.U. Reg. 2078/92 (drs/stremma)	9900			
Gross Revenues	70580		71540	
Production Expenses	drs/str	%	drs/str	%
1. Land Rent	20603	30	20400	32
2. Labour	19834	29	14723	23
a. Family	8390		4974	
b. Hired	5611		1528	
c. Hired Mechanical	5883		8191	
3. Fertilizers	2706	4	2649	4
4. Pesticides	-	-	2570	4
5. Biological Control	48	0	-	-
6. Fuel	5209	8	4846	8
7. Power	1913	3	1566	2
8. Seeds	2420	4	3181	5
9. Irrigation	1271	2	1550	2
10. Insurance	655	1	126	0
11. Organic Certification	1237	2	-	-
12. Interest on variable costs	1947	3	2043	3
13. Depreciation	11280	16	10772	17
Total Cost	69128	100	64426	100
Family Farm Income	32392		34531	

Table 3. Revenues, production costs and family farm income in organic and conventional cotton farming, Group B, Viotia-1995-96.

	Organic operations (n=7)		Conventional operations (n=9)	
1. Yield (kg/stremma)	266		337	
2. Price (drs/stremma)	296		285	
3. Value of Production (1x2)				
4. E.U. Reg. 2078/92 (drs/stremma)	9900			
Gross Revenues	88636		96045	
Production Expenses	drs/str	%	drs/str	%
1. Land Rent	18750	29	26207	32
2. Labour	17344	27	17178	21
a. Family	8884		6912	
b. Hired	3932		1888	
c. Hired Mechanical	4528		8378	
3. Fertilizers	4345	7	4945	6
4. Pesticides	-	-	2990	4
5. Biological Control	0	0	-	-
6. Fuel	8700	13	9714	8
7. Power	3641	6	2782	3
8. Seeds	2956	5	2977	4
9. Irrigation	750	1	1695	2
10. Insurance	343	1	852	1
11. Organic Certifications	271	0	-	-
12. Interest	2225	3	2457	3
13. Depreciation	5999	9	11536	14
Total Cost	65324	100	80333	100
Family Farm Income	53171		51288	

Table 4. Revenues, production costs and family farm income in organic and conventional cotton farming, Group C, Viotia-1995-96.

	Organic operations (n=7)		Conventional operations (n=10)	
1. Yield (kg/stremma)	236		321	
2. Price (drs/stremma)	310		291	
3. Value of Production (1x2)				
4. E.U. Reg. 2078/92 (drs/stremma)	9900			
Gross Revenues	83060		93411	
Production Expenses	drs/str	%	drs/str	%
1. Land Rent	20500	34	26800	39
2. Labour	17149	29	10938	16
a. Family	3105		4127	
b. Hired	9194		1925	
c. Hired Mechanical	4850		4886	
3. Fertilizers	2255	4	4209	6
4. Pesticides	-	-	3319	5
5. Biological Control	565	1	-	-
6. Fuel	6070	10	5640	8
7. Power	2291	4	1714	3
8. Seeds	2980	5	3151	5
9. Irrigation	750	1	1638	2
10. Insurance	94	0	212	0
11. Organic Certifications	358	1	-	-
12. Interest	1826	3	1810	3
13. Depreciation	4820	8	8637	13
Total Cost	59658	100	68068	
Family Farm Income	48833		58080	