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Comparative socio-economic analysis of bean farms under conventional and integrated crop management

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Abstract. The purpose of this study is to analyze the social features of the producers and to compare the expenses, revenues and income from bean farms under conventional and integrated management. A comparison was made between average farms under integrated management and those under conventional management as to the techno-economic data and their economic results. The research was conducted in Western Macedonia, in Florina Prefecture, during 2009–10, and was based on questionnaires, which were filled in during personal interviews. The results of this research showed that the average bean farm under integrated management has slightly lower production cost and lower gross revenues compared to the average bean farm under conventional management; as a result, all the additional economic results of the farms under integrated management are lower than those of conventional management.

Key words: beans, integrated management, techno-economic analysis

INTRODUCTION

The problems created by conventional agriculture that uses pesticides and fertilizers exhausting farmlands through management systems that fail to maintain environmental balance has led to international research for alternative forms of agriculture, friendly to the environment. Consumers, too, are now searching for new quality features of products, in addition to the traditional ones, which also respect as well as environmental concerns. An alternative form of agriculture that could replace the conventional agriculture is integrated crop management (Parra-Lopez et al., 2007).

Within the European Union 5.4 million hectares are cultivated under the integrated management system (European Commission, 2008). In Greece, significant efforts have been made towards integrated crop management over the past few years. Nevertheless, integrated agriculture prevails in only a small percentage of the total farmland of approximately 29,300 hectares (Ministry of Rural Development and Food, 2010).

Integrated crop management is a cultivation system based upon the rational and joint use of all available means and inflows in order to achieve the best economic result of a farm and to secure the quality of products, the producer and consumer's health, at the same time, without disturbing the environment (IOBC, 2010).

Several studies have shown that in most of the EU member countries, integrated agriculture leads to lower variable expenses and to lower variable production cost, mostly due to the reduction in expenses for pesticides and fertilizers. The price of the integrated management products in the EU countries is the same as that of conventional agricultural products in most cases studied (Theocharopoulos, 2009). Yield of cultivation under integrated management remained almost the same as those of conventional agriculture in 66.7% of the systems; it was lower in 22.2% and occasionally lower or higher in 11.1% of the systems. The gross revenue remained the same in 55.6% of the systems; it proved lower in 33.3% and higher in 11.1% of the cases studied. The gross profit in 44.4% of the systems remained almost the same as those in conventional agriculture; it increased in 22.2% and decreased in 33.4% of the integrated agriculture systems (European Commission, 2003).

Comparative research made in Greece comparing integrated management and conventional cultivation of peach trees showed that the yield of integrated management is 19.0% lower than the yield of the conventional method. Peach prices in integrated management were 5.4% higher than those in the conventional. The production expenses of the integrated agriculture were 17.4% lower than the expenses of the conventional agriculture (Theocharopoulos, 2009). The economic results of the integrated management proved lower than those of the conventional management. The same research showed that there are no statistically significant differences between producers of the conventional and integrated management concerning their age and education.

Swezy et al. (2007) compared tobacco cultivation systems in the U.S.A. The yield of farms under integrated management was 19.4% lower compared to conventional management; production cost proved 28% higher in the integrated agriculture. Research on types of olive cultivations in Spain showed that the integrated agriculture has 10.0% higher value than the conventional agriculture (Parra-Lopez et al, 2007).

The common white bean cultivation is the third and most important in consumption of legumes worldwide (Gomez, 2004). Bean cultivation, a traditional crop of the Greek mainland, was also affected by this trend. The good quality of the Greek bean, as well as the rising demand of pulses, that have been increasingly linked to a healthy diet, have led to the creation of a consumer ‘movement’ that seeks high quality products and greater variety in food. Bean is mostly cultivated in many areas of Western Macedonia, for example, in the vicinity of Prespes Lakes. The bean of Prespes has been part of the integrated management system since 2004, with the goal of producing safe, quality products as well as to achieve excellent environmental management, especially in the area that has been qualified as National Park. The beans of Prespes are of excellent quality and have great nutritional value, due to their location and type of production. According to this integrated management system, Prespes beans are cultivated under a system of modern agricultural practice with respect to the environment, thus are safe and high quality products for both the environment and man, i.e. the producers and consumers of Prespes beans.

As a result, bean cultivation has become one of the most important – in economic and social terms – crops of the area. Consequently, analysing and studying the features of producers and of their farms may lead not only to the further adoption of alternative forms of agriculture, but to the protection of the environment as well, which will promote the socio-economic development of the area at the same time.

MATERIALS AND METHODS

The research was conducted during 2009–10 in Florina Prefecture, specifically in the broader area of Prespes Municipality; questionnaires were completed during personal interviews with the producers. The sample studied in this research, as to the bean producers that joined the integrated management, included all forty local producers, according to the data of the Agricultural Cooperative 'Pelekanos' and of the Union of Agricultural Cooperatives of Florina Prefecture for the time period of 2009–10. An equal number of conventional cultivators were also identified.

To make this research easier and more effective, two different questionnaires were created for each of the bean producers' groups (under integrated and conventional management) with the same or similar questions. The questionnaire was separated into three basic units: the first included questions on the personal features of the farm leaders, their networking as well as their training during their active years in agriculture; the second unit dealt with general features of the farms, and the third unit concerned attitudes, and motives and sources of information that led bean producers to join the integrated management trend. Therefore, all factors that affected the producers' decision to adopt or not this cultivation system were successfully recorded.

The primary data were analysed in the SPSS 17.0 using descriptive statistics for studying the personal features of the leaders and for creating profiles indicating differences or similarities among attitudes, opinions and farm features. Economic conditions of the farms were determined by comparative techno-economic analysis of the average bean farms under conventional and integrated management. In addition, the costs, revenues and income from the integrated management of bean farms were compared to those from conventional management.

Finally, a *t*-test was applied to selected parameters to evaluate the differences in means between two groups. The *t*-test is one of the most popular techniques used for the assessment of the statistically significant difference between two average scores of two independent samples.

RESULTS AND DISCUSSION

Descriptive statistics results

According to the research results, the majority of bean cultivators under integrated management were men (70.0%), farmers by profession (100.0%), 20–50 years old (72.5% - average age, 43.4 years), and married. Of those who undertook integrated management, 95.0% were members of a cooperative or a producers' group, 60.0% had attended seminars on agriculture in the past and had completed 9.5 years of education on average. Family tradition was the most important motive for becoming a

farmer (47.5%); having a satisfying income (20.0%) and a different way of living (7.5%) were the second and third most important motives respectively (Table 1).

The total size of the cultivated land of bean producers under integrated management varies from 2.5–28 hectares, 10 hectares being the average. More specifically, 67.5% of the bean producers that adopted the integrated management system cultivate 5–10 hectares, 27.5%, 10–20 hectares; only 5.0% of the producers under integrated management possess more than 20 hectares of bean farms. It is worth noting that the majority of the integrated management producers (82.5%) have less than 25 years of agricultural experience, 17.5 % of them 25–35 years of experience and none of the integrated cultivators have worked in the agricultural sector for more than 35 years.

As to the personal features of the conventional bean producers, most are men (77.5%) and farmers by profession (92.5%); they are up to 50 years old (57.5%) – 46.3 years being the average age, and are married. Most, 82.5%, of the conventional bean producers are not members of a cooperative or a producers group, have never attended an agricultural seminar, and have completed 8.7 years of education on average. As in the case of the integrated management producers, family tradition was the most important motive for producers to become farmers by profession (55.0%), whereas having satisfying income and a different way of living were the second and third most important motives for 20.0% and 10.0% of producers respectively (Table 1).

The total size of the cultivated land of the conventional producers varies from 1 to 14 hectares, averaging 5 hectares. More specifically, 70.0% cultivate up to 5 hectares, 17.5% 5–9 hectares, and only 12.5% possess more than 9 hectares of bean farms. As to farming experience, in the primary sector, 42.5% have up to 15 years of experience, 20.0% of them 15–25 years and 37.5% have worked in the primary sector for more than 25 years. Consequently, the profile of bean producers under integrated management and under conventional management could be formulated as follows:

Table 1. Profile of producers under conventional and integrated management.

Integrated Management Producer	**Conventional Producer**
Average age: 43.4 years	Average age: 46.3 years
Education: 9.5 years	Education: 8.7 years
Family Tradition in Agriculture	
Average Size of Bean Farms: 10 hectares	Average Size of Bean Farms: 5 hectares
Agricultural Experience: 19.32 years	Agricultural Experience: 20.10 years
Member of a Cooperative or Producers' Group	Non-member of a Cooperative or Producers' Group
He attended seminars on agriculture	He did not attend seminars on agriculture
Main profession: Farmer	

Source: Research data

Comparative economic analysis of bean farms under integrated and conventional management

The gross revenue of the average bean farm under integrated management is 2.4% lower than that of the average conventional bean farm (Table 2). More specifically, the producer's price paid to integrated management cultivators for the Greek white kidney bean (giant-elephant) is 8.6% higher than in conventional agriculture, whereas the price of the flat bean is 7.1% lower than the conventional bean 'plake' respectively. This is probably because trading of the conventional bean is done individually and varies accordingly; consequently, the selling price of this bean may increase.

On the other hand, the trading of the bean produced under integrated management is usually managed through a cooperative; producers receive a fixed price for their product. Despite the fact that producers of the average bean farms under integrated management receive a small subsidy, they do not have higher gross revenue than the conventional producers. As to production expenses, less money is spent for the average bean farms under integrated management compared to those under conventional management. More specifically, the total labour cost for the farms under integrated management is 9.2% lower than that for conventional management, because the family labour cost represents a small part of the total labour cost in the farms under integrated management, representing only 3.1% of the total production expenses (Table 2).

In other words, producers under integrated management employ 13.7% more workers that are not members of the producer's family; on the contrary, family members work along with the producer in 45.7% of the cases of the conventional management. On the other hand, capital expenditure for the integrated management is 4.8% lower than in conventional management. Despite the certification cost that burdens only integrated management (90,0 € ha^{-1}), cultivators of the integrated bean farms management have 4.6% lower variable expenses and 5.7% lower constant capital expenditure annually (ex interest). Consequently, these producers have slightly lower total capital expenditure. One reason is that integrated management has specific limitations and rules concerning cultivation methods and allows use of only a small amount of fertilizers and pesticides. Despite the fact that the soil expenses represent a small percentage of the total production cost in both integrated and conventional management, the research showed that soil expenses are 16.1% higher in the bean farms under integrated management (Table 2).

In spite of the high total production cost required for the average conventional bean farm, the higher gross income leads to the increase of all additional economic results of the conventional farms, compared to those under integrated management. More specifically, the net profit of the conventional farms is 2.1% higher than the net profit of the bean farms under integrated management. Moreover, the agricultural income, family income, land revenue, net revenue and the labour revenue of the integrated management are lower than the income and revenues of the conventional farms respectively (Table 3).

Table 2. Gross revenue and production cost of the average bean farm under conventional and integrated management.

	Farms under Integrated Management	Conventional farms
I. Gross Revenue		
1. Yield (kg ha^{-1}***)***		
giant-elephant (white kidney) bean	2,886.2	2,820.1
bean 'plake'	2,786.4	2,857.9
2. Price (€ /kg)		
giant-elephant (white kidney)	2.76	2.54
bean 'plake'	2.72	2.92
3. Production value (€ ha^{-1}) (1*2)		
giant-elephant (white kidney) bean	7,958.8	7,163.2
bean 'plake'	7,565.0	8,352.1
4. Subsidy (€ ha^{-1})	90.0	
Total	**7,987.7**	**8,184.4**
II. Production Cost (€/ha)		
1. Land	*893.1*	*768.9*
Imputed rent	264.8	363.3
Actual rent	628.3	405.6
2. Labour	*721.8*	*795.4*
Family labour	167	307.7
Hired labour	554.7	487.7
3. Capital	*3,788.3*	*3,978.3*
Depreciation, maintenance and insurance premiums of constant capital	1,204.1	1,277.1
Constant capital interest	640.2	695.1
Variable capital interest	91.6	96.1
Consumed (fertilizers, pesticides, etc.)	1,822.5	1,910.3
Certification costs	30	
Total	**5,403.2**	**5,542.7**

Source: Research Data, 2010

Table 3. Economic results of the average bean farms under conventional and integrated management.

Economic results (€/ha)	Farms under Integrated Management	Conventional farms
Net profit	2,584.5	2,641.3
Gross profit	6,165.2	6,261.7
Farm income	4,931.1	5,482.9
Farm family income	3,656.5	4,589.5
Land revenue	3,477.5	3,410.3
Net revenue	4,209.3	4,687.3
Labour revenue	3,306.2	3,436.8

Source: Research Data, 2010

Finally, a *t*-test was applied to evaluate the differences in means between the two independent groups. This technique was applied to selected parameters between farms under conventional and integrated management. The results showed that the differences noticed between the conventional and the integrated production are not statistically significant (significance level 5.0%) in four out of five variables: gross revenue ($t(66) = 1.332$, $p = 0.19$), labour cost ($t(78) = 0.473$, $p = 0.638$), capital expenditure ($t(62)=0.097$, $p = 0.923$) and total production cost ($t(56)=0.200$, $p = 0.984$). Only land expenditure seems to have a statistically significant difference between the farms under conventional and integrated management ($t(78)=2.950$, $p = 0.004$).

CONCLUSIONS

Over the years, consumers have been searching for safer and better quality products, because of the problems induced by conventional agriculture. The quality of the existing agriculture may be improved by alternative forms such as integrated agriculture. In this survey, the features of bean producers and of their farms were studied in order to create a more inclusive view of the question treated. A comparative techno-economic analysis of the average bean farms under conventional and integrated management was also employed.

The descriptive statistics results showed that the producers that adopted the integrated management system are younger, more educated (in terms of years), attended seminars on agriculture, are members of a cooperative, cultivate larger areas with Prespes beans and have less experience on average in agriculture compared to the conventional producers.

The comparative techno-economic analysis of the average farms under integrated and conventional management proved that the gross revenue of conventional farms is higher (almost 200 € ha^{-1}) than the farms under integrated management, mostly because of the higher selling price of the conventional flat bean. As to the total

production cost, bean cultivation under integrated management requires less production expense than the conventional bean cultivation, due to lower capital cost that derives from reduced variable expenses (fertilizers, pesticides, etc.) and annual costs of fixed capital (depreciation, maintenance and insurance premiums), despite the increased (16.0%) land costs of the integrated management farms.

The economic results showed that adopting an integrated management system does not necessarily lead to higher profit, despite the reduced production costs. The profit from the conventional farms is 2.1% higher than the profit from integrated management farms. This is probably due to the higher gross revenue from the conventional farms. Consequently, all the additional economic results of the conventional farms proved higher than those of the farms under integrated management.

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