Original scientific paper

ECONOMIC ANALYSIS OF APPLE PRODUCTION IN MACEDONIA: THE CASE OF PELAGONIA REGION

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Abstract

Apple production in the Republic of Macedonia holds the greatest importance among all fruit crops in terms of export value, production quantity and area of land under apple trees. The favorable climatic conditions and the long-established tradition of growing apples offer huge potential for the development of this branch of fruit growing.

Low productivity levels and high production costs of apple put major limitations to the competitiveness on domestic and foreign markets, mainly due to inadequate and obsolete cultivation practices and technologies applied.

The research addresses the economic performance of family agricultural holdings. For the purposes of the analysis, a filed study has been conducted on 39 apple holdings in Pelagonia region for the production years 2009 and 2010.

Besides the standard performance indicators, the following social and economic factors affecting the apple producers performance have been analyzed: area of land, farmers' age, gender issue, apple varieties and land location. The methods of descriptive statistics and empirical methods of data analysis were used to process data.

The findings demonstrate that apple trees are produces on small areas, with very high plant protection costs and seasonal work force. Farms' economic success depends on the apple variety as well as the location of the orchards. Farmer's/manager's age correlates poorly with the farm's success, whereas farms with greater economic size are more successful in apple production.

Key words: apple producers, economic analysis, Pelagonia region, performance indicators.

Introduction

Fruit production is of considerable importance to the Macedonian economy. According to the latest Agricultural Census (SSO, 2007), orchards encompass area of 11,264 ha, out of which apple orchards take 38%, plums 19%, peaches 13%, sour cherries 12% and the rest belongs to other fruits. The area under orchards in the individual farms sector increased from 11,756 ha in 2007 to 12,903 ha in 2010, whereas the orchards' area at business entities has decreased from 1,644 ha in 2007 to 1,029 ha in 2010 (SSO, 2008 - 2011).

The production of apples, in the period from 2004 to 2011, in average amounts to 118,000 tons. The production itself had an upward trend with a 32% increase, hence from 82,414 tons in 2004 to

124,552 tons in 2011; the number of fruit-bearing trees in 2011 reached 4.3 million, which is a 16% increase when compared to 2004 (SSO, 2012).

Within the fruit sub-sector, apple production is with highest perspective and significance in our country and is spread on total agricultural area of 4,113 ha. Apples are net-export product generating an average annual inflow of 9.3 million euro for the period 2004 to 2011 година (SSO, www).

The highest concentration of apple plantations is in the region of the great lakes at about 700 m above sea level; this area is situated in the geographical regions of Pelagonia and South-West as determined by the State Statistical Office (SSO), and comprises 3.352 ha or 79% of the total area under apples (SSO, Ag Census, 2007). The focus of this study is the production of apples in the Pelagionia region where the respective share is 67%, i.e. it concentrates on the municipalities of Resen (with 2.567 ha, 99% of total area under fruit orchards) and Bitola (135 ha or 54% of total area under fruit orchards).

The aim of this paper is to conduct an economic analysis of the performance of the individual apple producers, in the Pelagionan region as the biggest apple production region in the Republic of Macedonia. The paper is structured into several chapters; following the introduction is the material and methods chapter, the presentation of the results and the discussion, and the conclusions are given in the end along with some recommendations for improvement of the economic performance of the apple producers.

Material and Methods

This research is based on primary and secondary source of data. The target group are the individual agricultural holdings (family farms) that according to the Agricultural Census data operate on 94% of the total area under apples. The survey refers to the production years of 2009 and 2012; it includes data from 39 individual agricultural holdings. To facilitate the data collection, a questionnaire was designed and a field survey was conducted. Additionally, many farmers were interviewed individually with an additional set of questions mainly covering the issues of farms assets and investments. Apple production experts were also consulted during this process. Following the initial data processing, a panel discussion was organized with relevant participants from the sub-sector: apple producers, researchers and scholars, processors, producers of plant material, преработувачи, advisors and extension agents. Data from the official statistics as well as results from previous studies were used as secondary sources.

In order to determine the sample size, a calculation of the maximum allowed error threshold was calculated, which represents half of the length of the appropriate confidence interval i.e. margin of error. Higher level of the margin of error will mean smaller sample, and vice versa. Factor in the determination of the upper limit of error level is the sample variation, or the standard variation (Delova Jolevska, 2008).

The determination of the sample size depends upon three factors: confidence level, upper error limit and the variability of the statistical mass expressed through the variance (Risteski, 1999). The interaction of these three factors is expressed as follows:

$$E = Za/2 * \frac{\delta}{\sqrt{\mathbf{n}}}$$

The optimal sample size is calculated according to the following formula (Delova Jolevska, 2008, Risteski, 1999):

$$n = \frac{\mathbf{N} * \mathbf{Z}_{\frac{\alpha}{2}}^{2} * \boldsymbol{\sigma}^{2}}{\mathbf{Z}_{\frac{\alpha}{2}}^{2} * \boldsymbol{\sigma}^{2} + \left(\frac{\mathbf{E}}{2}\right)^{2} * (\mathbf{N}-\mathbf{1})}$$

where as:

E = maximum margin of error

Z = standardized normal value corresponding to the confidence level

1-α = error risk

σ = standard deviation of the statistical mass

n = optimal sample size

N = sample size

The confidence level for the determination of our sample was set at 0.90, meaning that 90% of the mean of the sample will be in the interval of 1.64 standard deviations to the arithmetic mean of the statistical mass. The calculated optimal size of the sample was 37, and the survey was done at 39 farms.

In order to determine the economic performance of the farmers, standard performance indicators are used. The output/input value coefficient demonstrates the production efficiency (PE) or the productivity in the larger sense and is calculated as a ratio between the total value of the production output (OV) and the value of the total inputs (IV). Alternatively, it can be calculated in the reverse order i.e. input value over output value. The formula used in this paper is as follows:

PE = OV/IP

The apple production is recognized as efficient if this coefficient is higher than 1, i.e. when the total value of outputs is higher than the total value of inputs.

In order to determine the level of economic effectiveness of the farms, a calculation of the rate of profitability (RP) is applied, expressed as ratio of the farm profit (FP) over the total output value (OV):

RP = (FP/OV) x 100 (%)

Higher rates indicate higher profitability.

The cost of production of apples is also calculated, as a ratio of the total costs i.e. input value (IV) over the total quantity of product (PQ), and it is expressed in Macedonian denars per kg:

COP=IV/PQ

The survey included collection of data concerning the labor; it enabled a calculation of the labor productivity indicator as an important aspect of the farm economic analysis. The labor productivity (LP) is determined as a ration between the total value of output (OV) and the total cost of the labor input (LI):

LP = OV/LI

The labor compensation is a sum of the costs of hired labor and also the cost of family labor in terms of opportunity cost. The labor unit equals the annual workload of one person i.e. the Annual Work Unit (European Commission, Farm Definitions 2005) and is equivalent of 275 workdays or 2200 labor hours.

In order to systemize the output and inputs in apple production adequate analytical enterprise budgets were constructed, contacting both the variable and fixed production costs.

Standards methods of the descriptive statistics were used for the sample analysis and the analysis of the performance indicators; mean (M_x), standard deviation (SD) and coefficient of variation (CV). Lower values of the coefficient of variation, as a relative measure of dispersion, indicate lower deviation in the sample from the arithmetic mean, and vice versa (Risteski, 1999).

Results and Discussion

Description of the sample

The farm survey and individual interviews gave ground to describe the typical features of apple farms in the Pelagonia region.

In general, apple farms are characterized with high specialization in the Resen municipality, while in the Bitola municipality farms are usually of mixed character.

The total area of the included family farms in the survey is 84.22 ha. In average, an apple farm has 2.2 ha ov apple orchards, and this per farm area in the sample ranges from 0.1 ha to 8 ha. Farms are larger in the Resen municipality with an average of 2.5 ha, compared to the farms in Bitola municipality with 1.5 ha (Figure 1). The farms are highly fragmented, with 4 to 10 land parcels per holding.

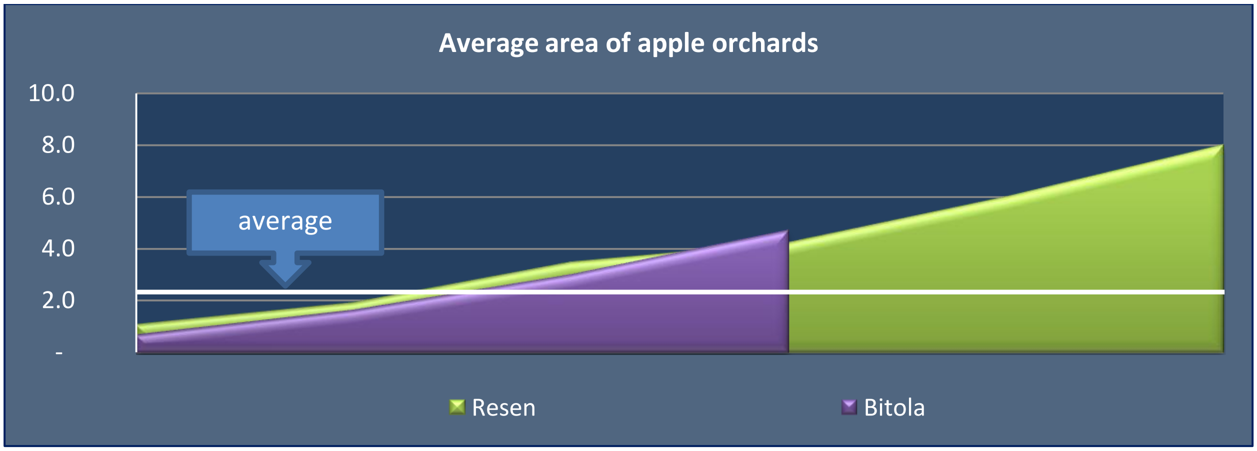

Figure 1. Average area of apple orchards, in ha per municipality

In term of farm assets, the survey showed that apple farms have obsolete machinery (17 years average. Almost all farms have some storage space, which are not always in good shape, and only few farms in the survey had cooling rooms, however, without controlled atmosphere. The average age of the apple orchards is 12 years. The irrigation technology is relatively advances and almost 70% of the sample farms are irrigated with dripping system.

According to the survey and the questions regarding the variety structure, the variety Ajdared is represented on 60% of the area, followed by the Golden Delicious with 13% of the area, and with Red Delicious and Muco taking 8% each. In Bitola municipality, the most common variety is Golden Delicious with 33%, Ajdared with 25%, followed by Granny Smith and Red Delicious varieties with 18% and 11%, respectively. In Bitola municipality only a small portion of the apples sells as industrial, compared with Resen region and therefore has a higher average producer prices by 40%. Unlike the Bitola, in Resen the most typical variety is Ajdared with 68% of the total surveyed area.

The research revealed that out of the total surveyed farms, there is only one woman farm holder. This indicates a low level of gender equality in terms of ownership, i.e. the holder of the agricultural economy, but the involvement of women in production, especially labor in harvesting as a family, is a highly prevalent and an average of 33% of the total family labor.

In terms of farm size in ha which is owned by farmers, farm holders by age 40 possess only 28% of the total area in the survey. By this age, the effects of learning by doing are the highest (Liu and Zhuang, 2000 in Passel and Huylenbroeck, 2007). Most of the total area, with 40%, is owned by farmers aged 48 to 54. According to the research of O'Neill *et al* (2001) in the United Kingdom, the efficiency of the farm lead by managers over the age of 48 years is negatively correlated.

Farm performance indicators

The analysis of the economic results is presented on hectare basis, on order to obtain more comparable averages.

According to the average budgets per unit area, it was determined that the fixed costs range from a minimum of 32,708 MKD/ha to a maximum of 220,213 MKD/ha, with an average of 91,713 MKD/ha. The coefficient of variation as deviation from the mean is 48.8%. The variable cost have expectedly lower coefficient of variation of 37.9%, and the values are in the interval of 42,718 MKD/ha to 322,962 MKD/ha with an average of MKD 155,154/ha. The average total cost to produce 1 ha of apples, on average amounted to MKD 246,867/ha, but if the costs for family labor are added up, the average total costs reach MKD 312,297/ha (see Figure 2).

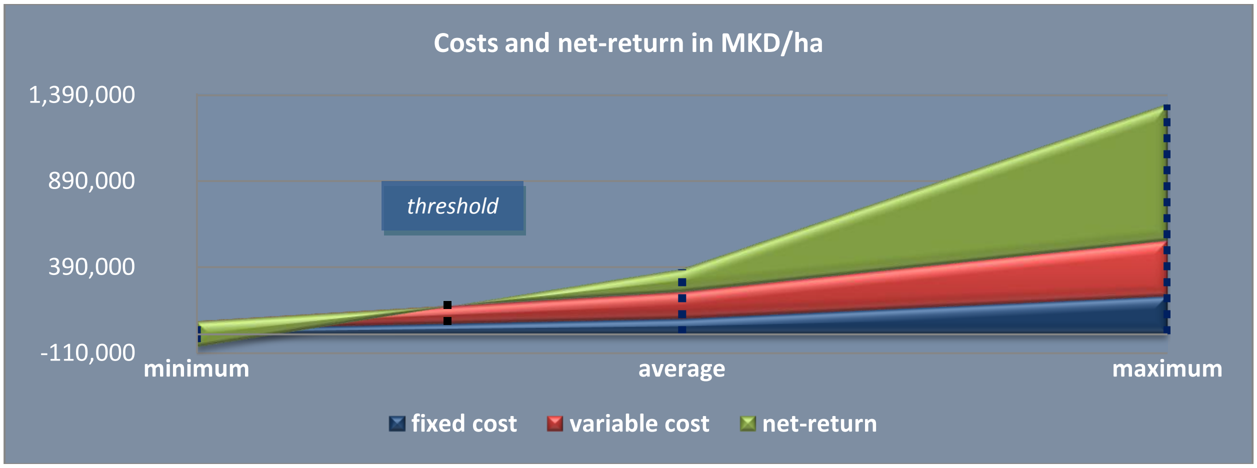

Figure 2. Costs and net return per ha

The family annual work unit, required for 1 ha of apple orchards, averages 0.5. The coefficient of variation is very high, amounting to 74.8% due to the different degree of utilization of family labor. In the entire sample, the farm of size of 0.1 ha of apple orchard, that does not use any seasonal labor, utilizes annually 0.2 AWU (around 880 hours) or 2.2 AWU if calculated on a hectare basis, which is indicative of very low productivity of family labor due to the smaller area.

Yields per unit area range from 10,732 kg/ha to 66,250 kg/ha with an average of 31,715 kg/ha and standard deviation of 11,120 kg/ha (see Figure 4). Average yields are relatively low, when compared with yields in France, Italy and Chile ranging from 50,000 kg/ha to 60,000 kg/ha. With regard to the farming systems with different tree densities, predictably highest yields are realized at orchards with the highest density of 1500 to 2499 trees/ha i.e. intensive plantations (see Figure 4). The trend is positive and consistent with the increase in the number of trees.

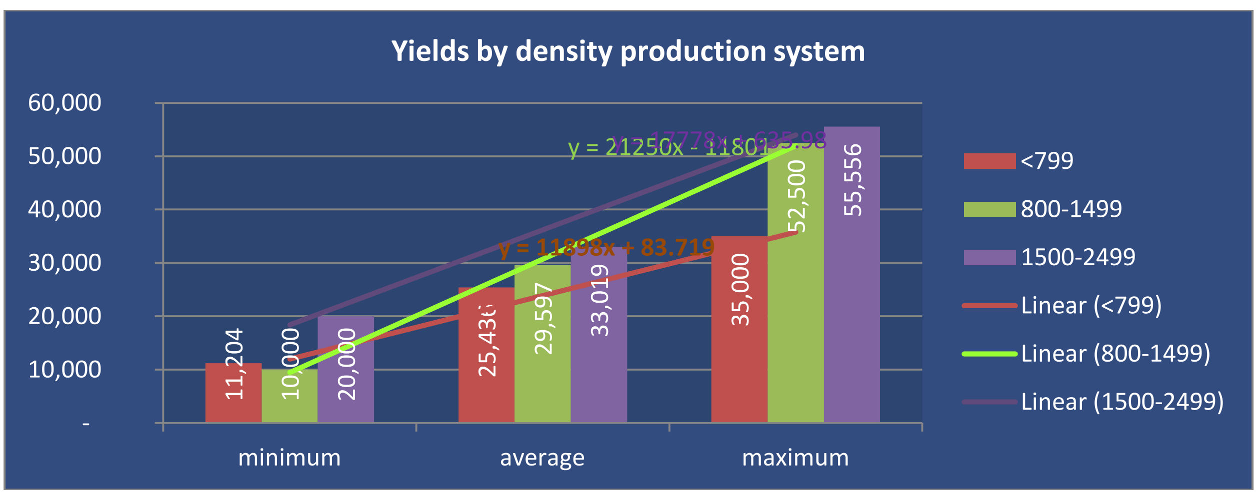

Figure 3. Yields by density production system

The average value of the gross margin of apple plantations amounts to 291,268 MKD/ha, with a high coefficient of variation of 76.2%, which indicates a large deviation from the mean. In the structure of total revenue, 35% is the share of variable costs and 65% is the share of gross margin (see Figure 4), which is generally a good indicator and indicates the ability of farms to cover fixed costs and to accumulate profits.

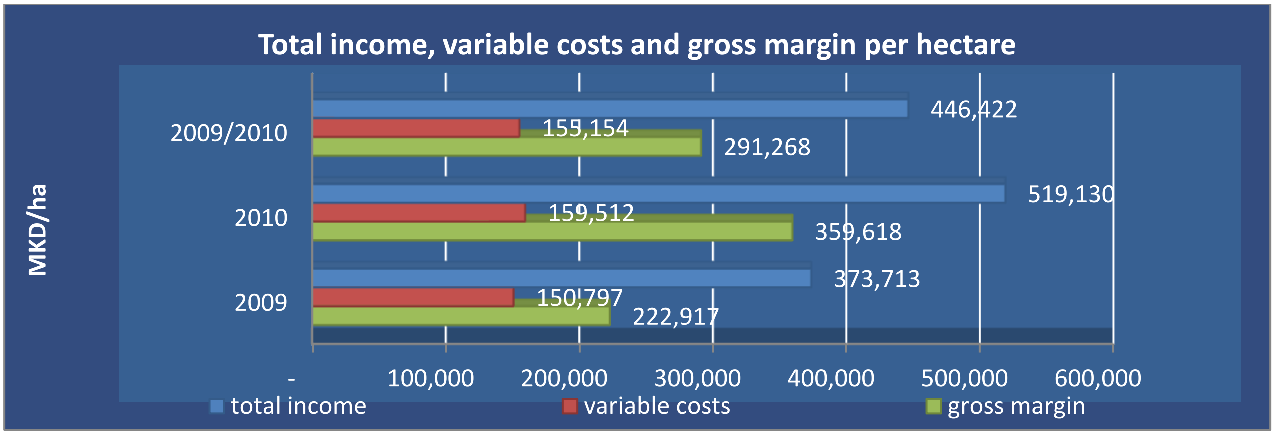

Figure 4. Total income, variable costs and gross margin per hectare

With the inclusion of the fixed costs, we get the financial result as the sum which remains on the farm and has average of 199,555 MKD/ha. The maximum value reaches 907,974 MKD/ha, but there are also a number of farms with very low profitability where the net profit is at a break-even level i.e. the difference between total costs and total revenues is negligible. These family farms are in most cases dealing with other activities and the production of apples is on a very small area. Family labor, which occurs as the opportunity cost, in practice rarely is calculated as a real cost, but when included as cost in the calculations, it significantly affects the results; in farms with low margin, with the inclusion of family labor as cost, the net margin becomes negative, reaching -148,980 MKD/ha or -139,613 MKD/farm (see Figure 5). Subsidies

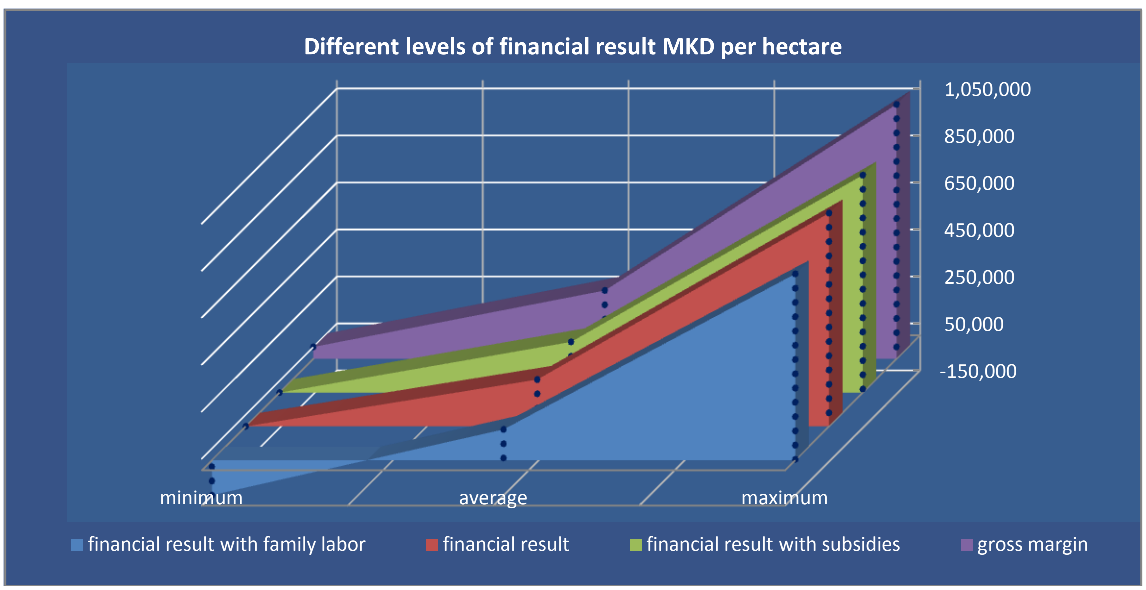

Figure 5. Different levels of financial result per hectare

The average cost of production at variable costs level amounts 5.1 MKD/kg of apple, while the full cost of production including both variable and fixed costs is higher by 36% and it reaches 8.1 MKD/kg. With the addition of family labor, i.e. its valorization as opportunity cost, the average cost sums up to 10.3 MKD/kg. The weighted average purchase (producer) price is 14.9 MKD/kg, in which the cost of production including the family labor participates with 69%. Figure 6 gives visible representation of the in cost of production at different cost inclusion levels.

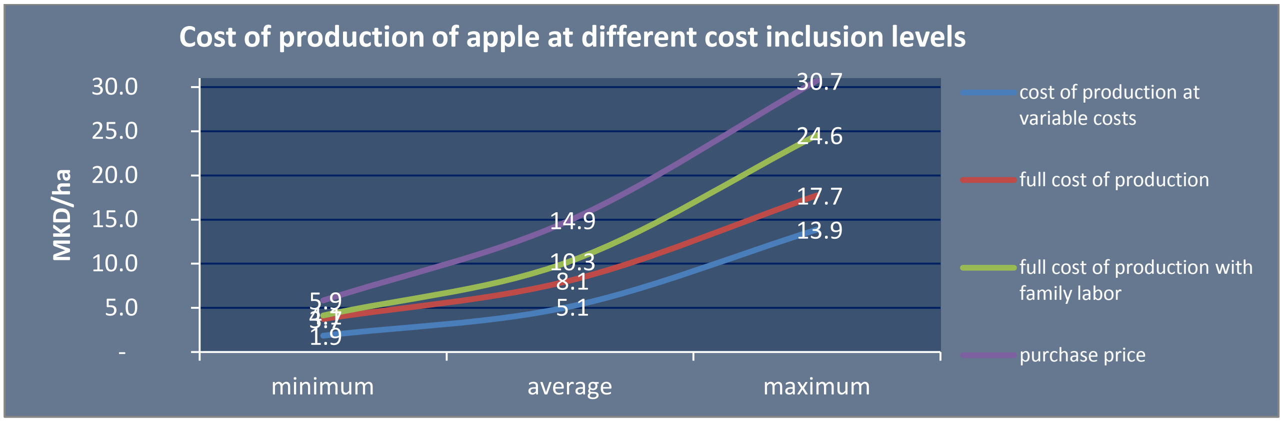

Figure 6. Cost of production of apple at different cost inclusion levels in MKD/ha

The average economic efficiency of production in output - input value terms, has a coefficient if 1.9. The lowest value in the sample is 1 representing farms that have a value of production equal to the amount of costs incurred, while the highest coefficient is 4.3. Subsidies do not have a significant impact on increasing the average value of the coefficient, but only cause a slight increase in the maximum.

The level of economic effectiveness, determined by the rate of profitability, is 43.4%. The coefficient of variation is 176%, which indicates huge difference in the degree of profitability among farms

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Table 1. Performance indicators of apple producers

Indicator	**Year**	**No of farms**	**Area**	**M_x**	**Max**	**Min**	**SD**	**CV**
Production efficiency (output value/ input value)	**2009**	39	78.1	1.6	4.1	1.0	0.8	50
	2010	39	78.1	2.1	4.3	1.0	0.9	41
	2009 /2010	**39**	**78.1**	**1.9**	**4.3**	**1.0**	**0.9**	**47**
Production efficiency, incl. subsidies (output value/ input value)	**2009**	39	78.1	1.6	4.1	1.0	0.8	50
	2010	39	78.1	2.3	4.5	1.1	0.9	39
	2009 /2010	**39**	**78.1**	**1.9**	**4.5**	**1.0**	**0.9**	**47**
Profitability rate (%)	**2009**	39	78.1	36.1	317.4	0.01	67.0	185
	2010	39	78.1	50.7	406.9	0.5	83.9	165
	2009 /2010	**39**	**78.1**	**43.4**	**406.9**	**0.01**	**76.2**	**176**

Based on the data concerning costs, yields and income (taking into account the area with apple plantations), an average analytical budget was constructed for the two studied regions for years 2009 and 2010. The analytical calculation gives a clear overview of the cost structure. The largest share of the total costs represented by 25.6% is due to plant protection, or 41% of total variable costs, followed by the depreciation of the machinery with 17% of the total cost or 46% of the total fixed costs (both cost items in total occupy 43% of the total costs). It is also important to stress the seasonal labor costs which amounted to 11.2% of the total costs; this is indication of the labor intensiveness of apple production (see Table 2). Accounting for 8.1% of the total cost is for fuel for machinery.

Table 2. Apple enterprise budget, average by location for 2009/2010 per hectare in MKD

	Resen average	Bitola average	Resen/Bitola average	Total
No. of farms (total)	27	12	39	**39**
Farm area (total)	62.2	15.9	78.1	**78.1**
Yield/ha	32,423	30,120	31,715	
Purchase (producer) price	12,3	20,5	14,8	
Income/ha	**398,959**	**617,853**	**470,337**	
	Resen average	**Bitola average**	**Resen/Bitola average**	**Cost Structure**
1.Variable costs/ha	**153,116**	**159,741**	**156,428**	**62.6%**
Manure	1,056	1,504	1,280	**0.5%**
Fertilizer	12,171	15,066	13,619	**5.5%**
Plant protection	66,726	60,946	63,836	**25.6%**
Machinery fuel	13,718	26,678	20,198	**8.1%**
Irrigation fuel and irrigation fee	6,198	10,830	8,514	**3.4%**
Packaging	15,034	16,769	15,901	**6.4%**
Hired labor	31,701	24,361	28,031	**11.2%**
Storage at third party	925	1,033	979	**0.4%**
Maintenance and repair	3,971	2,350	3,161	**1.3%**
Soil analysis	231	205	218	**0.1%**
Other costs	1,385	0	692	**0.3%**
2. Fixed costs/ha	**89,239**	**97,280**	**93,260**	**37.4%**
Depreciation of machinery	32,852	52,043	42,447	**17.0%**
Depreciation of buildings	22,253	16,803	19,528	**7.8%**
Depreciation of apple plantation	16,988	7,055	12,021	**4.8%**
Taxes, gross salaries, fees	16,928	19,688	18,308	**7.3%**
Other fixed costs	218	1,692	955	**0.4%**
Total costs (1+2)	**242,354**	**257,022**	**249,688**	**100.0%**
Total income – total costs	**156,605**	**360,832**	**220,650**	
Cost of production at variable costs per kg	**4.7**	**5.3**	**4.9**	
Cost of production at total costs per kg	**7.5**	**8.5**	**7.9**	

Conclusions

The favorable climatic and soil conditions, as well as a long tradition of growing apples, provide huge potential for the development of this sub-sector in our country. There is still lack of investments; the variety structure needs to be changed in line with the consumer demand, and change is needed in terms of up to date practices and technologies for growing apples.

The low productivity and high cost of production of apples emerge as major constraints to competitiveness in domestic and world markets, mainly because of inadequate and old fashioned cultivation practices, and reduced levels of application of inputs and technologies.

The research aimed to determine the performance operations of individual farms which are engaged in production of apples. The survey was limited to the Pelagonia region, where the apple production is the largest in the country. Overall, the findings reveal that the total income out of apple production on the individual farms can cover the production costs and accumulate profit. Exception is made by the findings when family labor is included as opportunity cost hence causing some farms to have negative financial results. The average yields are still relatively small (around 32 tons/ha) and could be increased. According these findings, the high-intensity way of cultivation is a prerequisite for increasing the competitiveness of the sector, due to higher yields per unit area and lower costs in the regular fruit bearing, as compared with other systems. Of the total area surveyed, the high-intensity farming is represented only by 1%.

Apple producers need to improve the production management and technology through education and information, with special emphasis on reducing costs and improving the quality of product. The plant protection should be well balanced and new methods could lead to decreasing the costs. Also, the cost of labor is high with share of 11.2%, without the involvement of family labor, which can be reduced by using farming systems that require less labor investment, especially in the cutting phase and harvesting, such as the super intensive systems.

From the findings of the performance and the social demographic aspects, younger farmers need to be more involved in managing the farm.

Farmers do not keep regular records, which further complicates the management of the farm. Not being aware of the farm performance does not allow making timely decisions and adjustments in the farm management. Therefore, it is a strong recommendation to farmers that want to operate commercially and successfully to maintain and improve the agricultural holding by keeping records.

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