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COMPARISON OF ECONOMIC EFFICIENCY OF ORGANIC VERSUS CONVENTIONAL FARMING IN THE CONDITIONS OF BOSNIA AND HERZEGOVINA

SUMMARY

Organic farming, which, as a modality of agricultural production, responsibly treats natural resources and fits into the concept of sustainable development, is increasingly prevalent, especially in developed countries. However, reconciliation of the interest and benefits of organic food producers and consumers is crucial for sustainability of that production. This adjustment is done through market prices. Prices of organic food must be acceptable for consumers, while at the same time should enable farmers to cover the cost of production and to make a certain profit. Organic food production is in a very early stage in Bosnia and Herzegovina (BiH). This paper is deducted to the analysis of the economic efficiency of organic food production based on case studies of three selected products, wheat, tomato and raspberry in the conditions of BiH. The aim of research was to quantify and evaluate economic efficiency of organic farming versus conventional farming. The obtained result confirmed the general trends, that the yields and sale price of agricultural products produced on the principles of organic farming are lower, and therefore revenues are higher. The expenses were higher for two products while they were lower for one product. However, in the end, gross profit in organic farming for all three products is higher than the profit generated in conventional farming. Thus, it may be concluded that, from the financial point of view, there is great chance and economic viability for organic farming in BiH, if there is demand for organic food consumption or conditions for its export.

Keywords: organic farming, organic food, economic efficiency.

INTRODUCTION

The need for food is one of the oldest human needs. Initially, humans found food in nature, and later they started to produce it for their own needs. After the first division of labour, there was a specialization in producing food and its trading with those who specialized in making other products. Historically, it was a very primitive way of production of food, but over time, the process of

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production was modernized and the traditional method of production abandoned. The modernization was happening in both different periods and directions, and the period of so-called green revolution was one of the most fruitful periods. The green revolution was driven by a technology revolution, comprising a package of modern inputs – irrigation, improved seeds, fertilizers, and pesticides – that together dramatically increased crop production (Hazell, 2009).

However, productivity and profit maximization are achieved through the use of numerous agro-technical measures that have had many adverse side effects on agro-systems (Sredojević et al., 2018) and questioned the viability of such a mode of production. According to Njegovan (2018) today there are more and more those who point out that the green revolution has had multiple negative consequences. In response to the destruction of biological diversity and other risks, primarily from a standpoint of security of food production and consumption, the concept of organic farming appears. Thus, there are two concepts of food production in the world, respectively conventional and organic farming.

Due to increasing consumer demand and political support, the popularity of organic food is increasing (Huang et. al., 2016) and it is produced in increasing quantities. Organic agriculture has been seen also as one of the ways to diversify agriculture (Jansky et al., 2003). Bosnia and Herzegovina is characterized by increase of the area under organic crops growing, from 292 ha in 2013, to 659 in 2016 (MOFTER, 2018). The value of exported organic products from BiH in 2017 was EUR 4 million. Both figures confirm that organic farming, although present, is still in its infancy. At the world level, Malek et al. (2019) mapped 112,724 certified organic crop farmers in 150 countries with estimation that there are only 5 percent of total organic crop farmers and with conclusion that a higher density of organic crop farmers is in high-income countries, and closer to larger cities. According Kyrylov et al. (2018) organic production is being practiced in 178 countries and covering of 57.8 million ha of agriculture land while about 90 percent of organic food and drinks are consumed in North America and Europe.

Organic production is also present in the region. According to Zrakić et al. (2017), 2,319 farmers on 50,054 ha were engaged in organic production in Croatia in 2016 and compared to 2013, the agricultural area under organic farming has increased by 23.1%. Montenegro has 285 registered producers of organic food in 2017 (Melović at. al, 2018). Veličković and Golijan (2016) state that 9.547 ha were in the status of organic production or conversion in the Republic of Serbia in 2016. According to Vlahović et al. (2019), about 10% of the land in Serbia is unpolluted and thus ideal for organic production, which can be significantly increased. It is similar in other countries of the Western Balkans, which have great potential for organic production, which, despite this, is still undeveloped.

A good overview of the state of organic production in the Mediterranean region can be found in MOAN (Mediterranean Organic Agriculture Network) report (2019). According to these data, Serbia has the largest area under organic

production, and Northern Macedonia has the largest share in the total agricultural area.

	Albania	BiH	Montenegro	North Macedonia	Serbia
Organic agric. area (ha)	549	659	2,797	2,900	13,423
Share of total agric. land (%)	0.08	0.03	1.09	2.9	0.39

Table 1. Area under organic farming in the Western Balkans (2017)

Organic farming is often suggested as an alternative for those who cannot be profitable in conventional farming (Jouzi et al., 2017), although, due to the capital and knowledge required, there are cases where organic farming is more often undertaken by big farms (Bazylevych et al., 2017). Organic farming is also a recommendation for farmers in BiH, especially those with traditional way of production and small holdings. According to the BiH Strategic plan of rural development (2018), organic farming for BiH farmers represents a significant opportunity to expand production, *inter alia* because the traditional production methods used in many ways correspond to organic farming principles and represents advantage for many farmers who would be interested in developing organic farming systems. The expectation was that many farmers would engage in organic farming where, with smaller production capacities, they could produce higher value products that would ensure greater profit (Vaško et al., 2009).

In the case of any farming, one of key commitments to engage in that production is the ability to earn money, i.e. its profitability. In searching the optimal cost-benefit ratio, farmers are considering different combinations of production factors and their use, and one of the dillemas is whether to apply a conventiona or organic farming system. Such a commitment to organic farming is not only a matter of moral commitment and special social responsibility, but also finding a financial interest in that choice. Therfore, the researches of economic efficiency of organic farming and commparing its financial results with results in conventional farming are always actual and in the function of rational decisionsmaking process.

MATERIAL AND METHODS

The aim of research was to calculate and compare the economic efficiency of organic and conventional farming in case of three selected agricultural products: wheat, tomato and raspberry. The research hypothesis has been formulated that organic farming is more economically efficient than conventional. The research method is based on a mathematic calculation of the profitability of selected products in the BiH market conditions, with a static valuation the input-output variables. Data on production and marketing conditions were collected by surveying one producer for each of selected products in both production systems. One product was taken as representative of crop, one for vegetable and one for fruit production. The research was conducted based on processing data from six case studies in which organic production represent the first, while conventional production represented the second production method.

Six mathematic models have been designed: organic (W1) and conventional (W2) wheat in the open field, organic (T1) and conventional (T2) tomato in greenhouse and organic (R1) and conventional (R2) raspberry in the open field. Since both variants of production took place in the same geographical area and in the same calendar year, the impact of climate conditions on yield is identical and has not been considered as a factor influencing the results achieved. In general, the first half of 2019 had a good distribution of rainfall, which resulted in good yield of wheat. Production of tomato was realized under irrigations conditions (in both variants). When it comes to raspberry, the year of 2019 is characterized by low sales price, which influenced lower revenue and profit in both models of production. The value of production (revenue), expenses and gross profit were calculated in each of the six cases, applying full cost analytical calculation method (formula (1)).

Gross profit = Revenue - Expensies =
$$\left[(Y * P + S) - \left(\sum_{i=1}^{n} x_i * p_i \right) \right]$$
(1)

where: Y – yield, P – sales price, S – subsidies, x_i – inputs and p_i – prices of inputs. Additionally, a comparison of two production methods was performed using partial budget analysis. The difference in gross profit (Δ GP) is determined at the level of revenue (Δ R) and expenses (Δ E) differences of each of the products in conventional and organic production system (formula (2)).

$$\Delta GP = \Delta R - \Delta E = (R_1 - R_2) - (E_1 - E_2)$$
(2)

The application of mentioned iterations and the calculation of the derived indicators was mythologically performed according to Vaško (2019). All amounts have been converted into \in for the purpose of international comparison. Organic producers selected for the case studies had certified organic production, and conventional producers were selected to be at approximately the same location and having approximately the same scope of production, to ensure the grater possible comparability of yield, cost and revenue data. Production of all products has been carried out in 2019, except in case of wheat, where it was autumn sowing in 2018 and the harvest in 2019.

RESULTS AND DISCUSSION

Generally, organic farming is a production system that sustains the health of soils, ecosystem and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects (IFOAM). The organic product is legitimized on the market and recognized through the certificate of the control organization, which confirms that the product is produced in accordance with the principles of organic farming. On the other side, contrary to organic products there are agricultural products and foodstuffs produced on the principles of conventional (traditional) production characterized by "intensive application of synthetic mineral fertilizers, pesticides, growth regulators and additives in animal nutrition" (Sredojević, 2002).

The following are elements of the amount and structure of revenues, expenses and profits of the selected products in both production systems (organic and conventional), with determined differences between them. All monetary amounts (except prices) are rounded to whole numbers.

Wheat

Wheat production was the least capital and labor intensive of all three analyzed productions. In both cases, the production was orgnized by family farms. The calculation of revenues and expenses was performed on the basis of 1 ha area.

	Organic	(W1)	Convention	Difference	
Area (ha)	1		1		0
Dry grain yield (kg ha ⁻¹)	3 500		4 600		-1 100
Price (€ kg ⁻¹)	0.46		0.29		0.31
Revenue from straw (€)	100		100		0
Subsidy per ha (€)	102		102		0
Subsidy per kg (€)	0		118		-118
Revenue (€)	1 764		953		811
Seed/Seedlings (€)	256	21.5%	51	6.4%	205
Fertilizer (€)	128	10.7%	194	24.2%	-66
Pesticides (€)	0	-	26	3.2%	-26
Machinery cost (€)	450	37.8%	481	59.9%	-31
Labour cost (€)	0	-	0	-	0
Certification cost (€)	307	25.7%	0	-	307
Other expenses (€)	51	4.3%	51	6.4%	0
Depreciation cost (€)	0	-	0	-	0
Total expenses (€)	1 192	100%	803	100%	389
Gross profit (€)	572		150		422
Gros profit margin (%)	32.4%		15.8%		

Table 2. Differential calculation of wheat production (1 ha)

In the organic wheat production, higher profit is achieved, both in absolute and relative terms. Significantly higher profit lies in the fact that the producer of organic wheat did not sell it in the form of grains, s/he rather processed it into flour, which s/he sold as organic flour. In this case, the revenue was calculated on the basis of the conversion of wheat grain into flour. Revenue of 1 ha of organic wheat is 85 percent higher than in conventional farming, although the yield is lower (by 1.1 t ha⁻¹) since the sales price is three times higher. It is surprising that the producer of organic wheat receives less subsidies since there is no premium per kg, because both types of wheat is processed on the same farm. The costs of organic wheat production are higher (+389 \in ha⁻¹), mainly due to the high cost of certification, which amounted to one forth of the total costs. In organic production, seeds were significantly more expensive, and due to the substitution of artificial fertilizers with organic fertilizers, the costs of fertilization were somewhat lower and there were no costs of chemical protection. In case of organic wheat production, the possibility of sale is crucial which is a result of difficulty of selling wheat grain at a price that would justify higher production costs.

Tomato

Both tomato productions were organized indoors (greenhouse) in the Banja Luka region.

	Organic (T1)		Conventio	Difference	
Area (m ²)	500		500		0
Yield (kg)	5 400		7 735		-2 335
Price (€ kg ⁻¹)	0.77		0.46		0.31
Revenue (€)	4 141		3 559		582
Seed/Seedlings (€)	460	19.3%	395	18.8%	65
Fertilizer (€)	77	3.2%	217	10.3%	-141
Pesticides (€)	158	6.7%	180	8.5%	-21
Machinery cost (€)	20	0.9%	20	1.0%	0
Labor cost (€)	736	30.9%	573	27.2%	164
Certification cost (€)	157	6.6%	0	-	157
Other expenses (€)	364	15.3%	311	14.7%	53
Depreciation cost (€)	409	17.2%	409	19.4%	0
Total expenses (€)	2 381	100%	2 105	100%	276
Gross profit (€)	1 760		1 454		306
Gros profit margin (%)	42.5%		40.8%		

Table 3. Differential calculation of tomato production in greenhouse (500 m^2)

Gross profit in organic farming was 21 percent higher than in conventional farming. Organic production had higher revenues, despite lower yields, due to higher sale prices. Expenses are also higher, as seedlings are more expensive as well as labour and other costs. Moreover, in organic farming, there are certification costs and not in conventional production at all. No subsidies were provided as an additional source of revenue, in none of two productions.

Raspberry

Both conventional and organic raspberry production was organized in the Bratunac region, an area where raspberries are traditionally produced in BiH. Revenues and costs are reduced to an area of 1 ha.

Notwithstanding the most labor-intensive, raspberry production provided the lowest profit margin and modest gross profit in regards to investment (mainly due to the low sale price in 2019, both organic and conventional raspberries).

	Organic (R1)		Conventio	Difference	
Area (ha)	1.0		1.0		0
Yield (kg)	7 500		11 000		-3 500
Price (€ kg ⁻¹)	1.07		0.77		0.31
Subsidy (€ kg ⁻¹)	1 150		1 687		-537
Revenue (€)	9 203		10 124		-920
Seed/Seedlings (€)	0	-	0	-	0
Fertilizer (€)	460	5.8%	552	6.0%	-92
Pesticides (€)	220	2.7%	547	5.9%	-327
Machinery cost (€)	1 074	13.4%	1 457	15.8%	-383
Labor cost (€)	4 499	56.2%	5 522	59.8%	-1 023
Certification cost (€)	598	7.5%	0	-	598
Other expenses (€)	128	1.6%	128	1.4%	0
Depreciation cost (€)	1 023	12.8%	1 023	11.1%	0
Total expenses (€)	8 002	100%	9 229	100%	-1 227
Gross profit (€)	1 201		895		307
Gros profit margin (%)	13.1%		8.8%		

Table 4. Differential calculation of raspberries production (1 ha)

In conventional raspberry production, the yield was higher by 3.5 t ha⁻¹ and this difference cannot be compensated by even 40 percent higher sales price of organic raspberry. The costs of organic raspberry certification were the highest of all three observed productions, but organic farming had lower machinery cost and costs of pesticides and fertilizers use. Despite the increased cost of manual land cultivation, total labour costs were lower due to lower harvesting cost.

	Wheat		Tomato		Raspberry	
	(1 ha)		(500 m ²)		(1 ha)	
	W1	W2	T1	T2	R1	R2
Sale price (€ kg ⁻¹)	0.46	0.15	0.77	0.46	1.07	0.77
Cost price (€ kg ⁻¹)	0.34	0.18	0.44	0.27	1.07	0.84
Price difference (€ kg ⁻¹)	0.12	-0.03	0.33	0.19	0.00	-0.07
Subsidy (€ kg ⁻¹)	0.03	0.05	-	-	0.15	0.15
Price difference with subsidies included ($\notin kg^{-1}$)	0.15	0.02	0.33	0.19	0.15	0.08

Table 5. Cost price, sale price and price difference of organic and conventional wheat, tomatoes and raspberry

The price differences

The highest gross profit margin was in tomato production, and the lowest in raspberry production. However, in absolute terms, there is higher gross profit in raspberry production than in wheat production. The production of tomatoes is not comparable, because it took place indoors, on a much smaller surface.

Considering different production areas and intensity of production, comparative results of production of three selected products in two variants (organic and conventional farming) are appropriate to be summarized through production cost (average unit cost of production) per kg and the difference between sales price (with and without subsidy) and cost price.

Without subsidies, conventional wheat and raspberry production is not profitable, and with the subsidies all production provides some positive difference between sale price and cost price. The greatest difference in price was achieved in production of tomatoes (both organic and conventional). Producers in 2018 did not take any special incentives for organic production, thus organic farming did not gain any advantage in terms of increased revenue or reduced expenses compared to conventional farming. Profits in organic agriculture are the result of higher sales prices of organic products, and in case of raspberries, lower cost.

At the beginning of the discussion of the obtained results, it should be kept in mind that "comparing organic and conventional system is still not an easy task because authors often adopt quite different methodologies, and different geographical areas" (Gomiero et al., 2011). So e.g. Lakner et al. (2018) find and point to quite different conditions and potentials of organic farms in Switzerland Austria and Southern Germany. Therefore, in the discussion, the exact numbers will not be compared from this and other researches obtained by reviewing the literature, but only the general relations, directions and tendencies.

As expected and in accordance with the results of most other surveys (such as in: Bavec, 2011; Bayramoglu and Gundogmus, 2008; Alaru et al., 2014; Lakner and Breustedt, 2015), the yields in the system of organic farming were lower than in the conventional. Summarizing metadata and compared 316 organic-to-conventional yields on 34 different crop species, Seufert et al. (2012) found that overall, organic yields are 25 percent lower than conventional.

Sales pries of organic products were higher than those produced in the conventional way, which is consistent with most other researces (e.g. Guesmi et al., 2012; Prodanović and Babović, 2014; Torres et al., 2016). Due to higher sales prices, despite lower yields, organic farming generates higher revenues than conventional (Bayramoglu Z. and Gundogmus, 2008; Guesmi et al., 2012; Prodanović and Babović, 2014; Lee et al., 2016). In this research, this was confirmed in case of wheat and tomato, but not raspberry, wheere there were the smallest difference in sales prices. Some researchers as Galnaityte et al. (2017) in Lithuania point out that the production of organic food is not profitable due to the fact that prices of organic products are not high enough, thus causing low profitability of production.

The expenses in organic farming were higher in the production of wheat and tomato. In organic raspberry production, expenses, despite more physical work in pest management, were generally lower because of less engagement of workers during harvest. Confirmations for these statements can be found in other studies that have more frequently mentioned higher costs in organic production (Bayramoglu Z. and Gundogmus, 2008; Guesmi et al., 2012; Torres et al., 2016; Lee et al., 2016), and rarely lower costs of organic production compared to conventional (Bodiroga and Sredojevic, 2017).

According to this research, agricultural producers in the organic farming system did not receive any subsidies for increased costs, especially its certification, as it is common practice in the EU and elsewhere (e.g. in Spain the subsidy covering 80 percent of the costs of registration and renovation with organic produce (according to Torres et al., 2016). Robertson et al. (2014) conclude that the reduction in income and profits of environmentally responsible farmers must be compensated, either by the state through subsidies from collected taxes or by consumers through the acceptance of higher prices of such food. In the BiH context, both ways are debatable, obtaining a subsidy for organic production is complicated, and few consumers are willing to consume more expensive organic products. Vehapi (2019) states that the purchasing intentions of Western Balkan consumers tend to fluctuate, i.e. to decline as organic food prices rise. Jovanović et. al (2017) confirmed that the opinion of the respondents is that the price of organic food in Montenegro is high, while at the same time Melović et. al. (2018) claim that prices for organic products in Montenegro is lover, compared to EU countries, are due to lower purchasing power. El Bilali et al. (2014) concluded that in Macedonia domestic market for organic agro-food products is still quite small.

The initial hypothesis that organic farming is economically more efficient than conventional was confirmed in all three cases (what, tomato and raspberry). This is consistent with the review provided by Nemes (2009) who, based on 44 studies representing 55 crops grown in 14 countries on five continents over 40 years, discovered that organic farming was actually from 22 to 35 percent more profitable than conventional agriculture, and his three-year monitoring and comparing the results of 204 conventional and organic farms in the Czech Republic (2013).

CONCLUSIONS

In Bosnia and Herzegovina, organic farming, as a positive example of the application of environmentally sustainable practices in agricultural sector, is in its early stage and is still practiced by a small number of producers. Therefore, it was not easy to find examples to compare the economic effects of organic versus conventional farming. Through three case studies financial effects were analyzed (revenues, expenses and profits) of production of wheat, tomato and raspberry in conditions of both organic and conventional farming. The financial result was determined by applying the analytical calculation of full costs and differential calculation (differences in yields, prices, revenues, expenses and profits). In all three cases, it was found that the yields in 2018 in organic farming were lower from 24 to 32 percent. However, due to premium prices, organic production revenues were higher for wheat and tomatoes and lower for raspberry sales prices

and the largest difference in yield. The costs for wheat and tomatoes in organic farming were higher than in conventional, mainly bacause of additional certification cost, and for raspberries lower because of lower yields and significantly lower harvesting costs than in conventional farming. All three products in organic farming had a higher absolute gross profit than in conventional farming.

The greatest difference in profit was acheived in wheat, primarily thanks to farmers' entrepreneurship, who did not sell organic wheat, than added value to it through on-farm processing into organic flour. The lowest profit was gained with raspberries due to the low sales price, regardless of the method of farming. Although there were certain incentives for organic farming in Bosnia and Herzegovina in 2018, organic farmers did not use them, thus receiving the same or even smaller subsidies compared to conventional farming (the case of wheat). The conclusion is that organic agricultural production is economically viable, if the market, through a higher price, respects the specific conditions of production of these products. Increasing profits, and therefore production of organic products, can also be achieved by allocating additional or increasing existing subsidies, as it is the case in developed countries.

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