Journal of Agricultural, Food and Environmental Sciences
UDC:338.439.4:639.3(497.11)
Original scientific paper

ECONOMIC ANALYSIS OF FRESHWATER FISH PRODUCTION IN THE REPUBLIC OF SERBIA

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Abstract
The authors present the basic characteristics of the fish production in the Republic of Serbia. In the case of the fishpond "OZZ Despotovo", in the municipality of Bačka Palanka, the main economic indicators achieved in the production of freshwater fish (carp, grass carp, silver carp, catfish) are analyzed. The observed production requires very high investment per unit area (€ 4,381.39 ha^{-1}). Despite significant investment, achieved economic results are relatively modest (the contribution margin € 892.15 ha^{-1}; the cost-effectiveness ratio 1.09; the profit rate 8.10%). System support of country in the modernization of existing fishponds and raising the new ones, it can significantly contribute to the improvement of production and economic results in the fish production on the territory of the Republic of Serbia.
Key words: freshwater fish production, costs, economic analysis.

Introduction

Limited resources in terms of fishing the saltwater fish species, as well as the growing need for freshwater fish, have led to the expansion of the area under the ponds in many countries around the world (*Trbović et al., 2013*). The potential of aquaculture seems to be even higher when one is considering that the catches of undomesticated fish have been constant or even declining slightly in recent years. Many waters are overfished and cannot provide the quantity of fish needed to satisfy the rising demand. This demand is driven by the growing world population and the overall increase in prosperity (*Subasinghe, 2006*). The emerging supply gap could be covered with products from aquaculture farms (*de Silva, 2001; Delgado et al., 2003*). Also, on the world market, fish from the pond is more valuable, since it is considered as healthier and safer than fish from free fishing. The reason lies in the fact that the ponds, in most cases, are away from the big polluters (*Đinović et al., 2010*).

Consumption of fish per capita is growing constantly worldwide, which is in accordance with the recommendations of nutritionists and doctors. This fact suggests that this type of meat is very important component of a healthy diet (*Ljubojević et al., 2013*). Fish provides the human organism with a sufficient amount of proteins, free amino acids, minerals and vitamins (*Ackman, 2000*), as well as sufficient quantities of polyunsaturated fatty acids (PUFA) (*Kminková et al., 2001*). Previous studies have shown that polyunsaturated fatty acids lower cholesterol levels in the blood, and may be significant in the prevention of cardiovascular disease (*Conor and Conor, 2010*). On the other hand, it also affects on the reduction of mortality among patients with coronary heart diseases (*Kris-Etherton et al., 2002*).

Despite of all these facts, the average annual consumption of fish, in R. of Serbia, according to data of the fishing, ponds production and fish import, is only 5 kg per capita (*Milijašević et al., 2012*). The reasons for the small use of fish in the diet are reflected in the low

purchasing power of the population, limited and inadequate offer on the market and lack of habit of using fish in the diet.

Fisheries consists of fish farming in ponds, open water fishing and fish processing. Aquaculture is defined as the controlled breeding of aquatic organisms such as fish, crustaceans, molluscs and plants (*Schulz et al., 2005*). Fish farming over time has become an important area of industrial production, and agriculture with fisheries takes a very important place in the R. of Serbia's economy. It is still constantly being developed and improved in order to satisfy as many growing nutritional needs of the population as possible. In our country, the main objective of fish farming is the production of consumable fish for the market, but also providing spawn for the needs of fish production and restocking the water out of the pond, in order to maintain fish stocks and contribute to the development of sport fishing (*Hristić and Bunjevac, 1991*).

Unfortunately, in the absence of a fisheries development's strategy in the Republic of Serbia, this industry is left to the uncontrolled and uncontrollable development. This is indicated by the fact that in the last few years the fishing farms, out of fear that they will not sell the produced fish, lowered prices below the production one, and thus create the basis for their material failure. On the other hand, development opportunities are great because the total fish production is only 30% of total consumption in the country, according to data of the Statistical Office of the Republic of Serbia and the Serbian Chamber of Commerce.

Development of freshwater fish production, as well as any other economic activity, should be also followed with adequate development of research in this area. Although R. of Serbia has a long tradition of warm-water fish ponds, as well as a large number of proven experts in practice, there is not enough research on the economics of fisheries (*Čanak, 2012*). For that reason, this paper aims to contribute to complementing the research and literature about the economics of freshwater fisheries. Also, the task of this paper is to provide answers to the most important questions about the cost-effectiveness of dealing with this branch of animal husbandry in agricultural production, based on the specific example of the pond "OZZ Despotovo", where the fundamental economic indicators achieved in the production of freshwater fish, particularly carp, grass carp, catfish and silver carp, were analyzed.

Materials and methods

This paper analyzes the main economic indicators of success that are realized in the fish production in R. of Serbia. The research is based on an analytical calculation of production, and data from the pond "OZZ Despotovo" is used for making the calculation. Calculation is primarily based on the calculation of the direct costs of production and cover margins as the main results. The additional indicators of success (profits, cost-effectiveness ratio and profit rate) will be calculated, in order to get more reliable assessment of the cost-effectiveness of this production. Also, sensitivity analysis method, examines the movement of financial results depending on changes in yield and / or market price, as well as changes in the most important direct inputs.

The paper presents the basic tendencies in fish production in R. of Serbia. For this purpose, we used data from the Statistical Office of the Republic of Serbia, as well as data from FAO base (for the period from 2005. to 2014.), which were analyzed with the classical statistical methods.

Results and discission

Fish production and turnover in the Republic of Serbia

According to the Statistical Office of the Republic of Serbia, in the last decade the area of carp ponds in R. of Serbia significantly increased. Looking at 2014, carp ponds were spread on 8,724 hectares, which is two times

more compared to ten years ago, when the total exploited area were 4,374 ha (2005). The above mentioned growth is accomplished at a rate of 7.89% per annum. The most common fish species are carp (83%), followed by silver and white carp (10.68%), grass carp (3.12%) and at the end catfish (0.30%).

In the same time period, the yield of freshwater fish is at the average level of 748 kg ha^{-1}, but at the same time it should be emphasized that the movement of yields, from year to year, is very unstable, as it is shown by the variation interval (Tab.1). There is a space for improvement of production techniques and technologies, which is also shown by the fact that in the analyzed period a negative rate of change in the yield per unit area is recorded. The total production of the most common fish species in the R. of Serbia is around 6,000 tonnes per year, with the annual growth of 6%. However, it is still only 0.009% of the world total.

Table 1. Areas, yields and production of consumable fish in Serbia (2005-2014)

Indicators	Average value	Coefficient of variation (%)	Variation interval		Rate changes (%)
			Min.	Max.	
Area (ha)	8.079	16,89	4.374	8.940	7,89
Yield (t ha^{-1})	0,75	13	0,59	0,87	-1,82
Production (t)	6.000	19,27	3.806	7.322	6

Based on the data from Table 2, it can be concluded that fish export from R. of Serbia is still symbolic, and it is an average of 126 tons per year. On the other hand, it is encouraging that carp export records growth rate of 15.56% per annum, while export of other types of fish has registered a growth too, but this growth was much more modest.

Table 2. Fish export from R. of Serbia (2005-2014)

Indicators	Average value	Coefficient of variation (%)	Variation interval		Rate changes (%)
			Min.	Max.	
Carp (t)	89,86	67,16	15,50	237,61	15,56
Other fish (t)	36,28	44,07	26	62,64	1,20

Although fish production increased in the last decade, but still together with the amount of fish catched from lakes and rivers, covers less than 30 percent of the domestic demand for fish, while more than 70 percent is imported. However, fish import in R. of Serbia, in the last decade, is characterized by a negative growth rate, 17.52% of carp, and 12.55% for other types of fish respectively (Tab. 3).

Table 3. Fish import in R. of Serbia (2005-2014)

Indicators	Average value	Coefficient of variation (%)	Variation interval		Rate changes (%)
			Min.	Max.	
Carp (t)	628	66	167,90	1.517	-17,52
Other fish (t)	391,72	54,98	61,73	696,64	-12,55

Economic analysis of freshwater fish production

For the analysis of profitability of freshwater fish production in the mixed pond "OZZ Despotovo", total costs are primarily classified into direct and general (Tab. 4). The total cost per unit area are very high, € 4,381.39 ha^{-1}. Such high costs, place aquaculture in rank of highly intensive productions.

Direct costs of this complex production include the following items: the cost of materials (spawn – one-year, two-year, food, hydrant lime, fuel and lubricants, other material), labor costs and direct services. In the framework of the direct costs, costs of pelleted food have the largest share (€ 1,661.78 ha^{-1}, or 37.93%). Nutrition with pelleted complete food allows a higher yield in all the categories of analyzed cyprinid fish (*Ljubojevic et al., 2012*). However, in many systems of fish farming in R. of Serbia, nutrition is still consisted of maize, wheat and barley, which reduces yield, and therefore the quality of produced fish. Also, significant cost represents spawn, which takes more than 1/3 of the share of total production costs. Together with the food cost, they include 72.89% of total costs. The remaining cost of materials (hydrant lime, fuel and lubricants, other materials) have no significant participation, so they take a share of less than 4%. Necessary expenses for labor in the analyzed semi-intensive pond amount to € 500.53 ha^{-1}, or 11.42% of total costs. In intensive production systems, these costs are much lower, so their reduction in the analyzed pond, can significantly affect the level of production economy. Direct services include the maintenance of the pond and do not represent a significant element of the cost. General costs are covered by the corresponding part of the depreciation of buildings and equipment, various overhead expenses, and interest on current assets, since it was assumed that the 1/4 variable investment was financed from borrowed sources of financing.

On the other hand, the value of production is mostly conditioned by the height of the achieved yields of certain fish categories. In R. of Serbia, yields in the fisheries sector, are modest in comparison with the yields which are realized in the world (*Markovic et al., 2014*). This is one of the key causes of low profitability of domestic aquaculture. On the analyzed pond, there is a polyculture, in which the dominant share in income have a three-year and two-year carp (88.66%). The rest of the revenue is generated by the sale of one-year carp, grass carp, silver carp and catfish. The total value of production per unit area, which is accomplished in analyzed pond, is € 4,767.36 ha^{-1}.

Looking at absolute indicators of success (the contribution margin, profit) which are achieved in the analyzed pond, it can be noted that in R. of Serbia relatively modest results are achieved in this production. Height of realized contribution margin (€ 892.15 ha^{-1}) and profit (€ 385.98 ha^{-1}) can not be considered as quality indicators for such an intensive production, which is characterized by high investments per unit of capacity. In almost all branches of agriculture, in R. of Serbia, better results are achieved in relation to the analyzed production, and analyzed pond respectively. Analyzing the relative success indicators, we also come to the same conclusion. The cost-effectiveness ratio, obtained by analyzing the mentioned production is only 1.09, and shows that on € 1 of the total costs, it is achieved € 1.09 of production value. The profit rate shows us that in the observed polyculture € 8.10 of profit is achieved at € 100 of production value. Both indicators have a low value, although this is a production that requires high investments of variable factors per unit of capacity.

Table 4. Calculation of freshwater fish production (2014)

		215 ha	215 ha	215 ha	1 ha	
No.	Costs	Quantity	Price (€ u.m.$^{-1}$)	Value (€)	Value (€ ha^{-1})	Structure (%)
1	Carp yearlings	12.794	2,73	34.927,62	162,45	3,71
2	A two-year carp fry	99.112	2,73	270.575,76	1.258,49	28,72
3	A two-year grass carp fry	2.910	2,05	5.965,50	27,75	0,63
4	A two-year silver carp fry	4.172	1,64	6.842,08	31,82	0,73
5	A two-year catfish fry	2.690	4,09	11.002,10	51,17	1,17
6	Pelleted food 25/7	533.562	0,47	250.774,14	1.166,39	26,62
7	Pelleted food 30/7	208.841	0,51	106.508,91	495,39	11,31
8	Hydrant lime	131.729	0,07	9.221,03	42,89	0,98
9	Fuel and lubricants			21.398,47	99,53	2,27
10	Other materials			6.709,78	31,21	0,71
O	**Cost of materials**			723.925,39	3.367,09	76,85
11	Labor costs			107.614,51	500,53	11,42
12	Direct services			1.630,27	7,58	0,17
A	***Direct costs***			***833.170,17***	***3.875,21***	88,45
13	Depreciation of buildings and equipment, overheads ...			101.226,45	470,82	10,75
14	Interest on working capital (1/4)	180.981,35	4,20%	7.601,22	35,35	0,81
B	***Overheads***			***108.827,67***	***506,18***	11,55
C	**TOTAL COSTS**			**941.997,84**	**4.381,39**	100,00
	The achieved results					
15	Carp 1	22.498	2,73	61.419,54	285,67	
16	Carp 2	74.594	2,73	203.641,62	947,17	
17	Carp 3	296.260	2,38	705.098,80	3.279,53	
18	Grass carp	8.351	1,88	15.699,88	73,02	
19	Silver carp	11.503	1,53	17.599,59	81,86	
20	Catfish	6.312	3,41	21.523,92	100,11	
D	**PRODUCTION VALUE**			**1.024.983,35**	**4.767,36**	
E	**CONTRIBUTION MARGIN (D-A)**			**191.813,18**	**892,15**	
F	**PROFIT (D-C)**			**82.985,51**	**385,98**	
G	**COST-EFFECTIVENESS RATIO (D/C)**				**1,09**	
H	**PROFIT RATE (F/D)*100**				**8,10**	

All absolute and relative indicators of success clearly testify that fish production in R. of Serbia is not at a high level of development, and therefore financial results are not sufficiently good and they are significantly below potential opportunities.

Most branches of agricultural production is inclined to fluctuations in achieved financial results in individual years. Therefore, sensitivity analysis was performed in the analyzed case, wherein tested changes of variables on which the financial result in the freshwater fish production is the most sensitive

(production value, value of food costs, value of expenditures of spawn).

Table 5. The flow of financial results with the change of the most important factors

	The movement of financial results (€ ha^{-1})			
Production value	-40%	-30%	-20%	-10%
	-1.520,97	-1.044,24	-567,50	-90,77
The value of food costs	+40%	+30%	+20%	+10%
	-278,74	-112,56	53,61	219,39
The value of expenditures of spawn	+40%	+30%	+20%	+10%
	-226,69	-73,52	79,64	232,81

It is an obvious lack of tolerance of analyzed production to change in production value. Already with the reduction of this parameter of 9%, the financial result becomes negative. The most important factors on the cost side are the value of food costs and value of expenditures of spawn. The change in their value financial results is more tolerant, since the negative financial result is achieved only with an increase of 24% and 26% respectively.

Conclusions

Based on the analysis it can be concluded that the fish production in R. of Serbia is still underdeveloped, considering that most of the production takes place at the semi-intensive ponds, with outdated supporting infrastructure, while there is a small number od modern fish pond. Production, which is organized in such outdated and semi-intensive ponds, simply is not cost-effective enough, relative to the volume of invested assets, as evidenced by the example of the analyzed fish pond "OZZ Despotovo".

R. of Serbia has a very favorable climatic and soil conditions for freshwater fish production, but the producers face with a subordinate position compared to other branches of agriculture, because there is no adequate stimulative policy for production, processing and marketing of fish. With stimulating support of the state and good fisheries's development strategy, from large importer, Serbia would be able to become an exporter of fish very soon. Export would be based primarily on the European Union's market and Russia, which annually imports about one million tonnes of fish.

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