

DIFFERENCES IN THE FINANCIAL MANAGEMENT OF CONVENTIONAL, ORGANIC, AND BIODYNAMIC FARMS*

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The financial management of conventional, organic, and biodynamic farms was evaluated and compared. It is a highly specific issue filling in the gap namely in the area of economic research of biodynamic agriculture. Biodynamic agriculture is a less widespread concept of agriculture, the management of which meets the requirements of organic agriculture. Organic agriculture has still been gaining in importance in the Czech Republic, the number of organic farms has been growing, and availability of organic products has increased, too. Of the Czech farms receiving subsidies from the EU or state subsidies in 2007–2012, a total of 389 were selected for analysis (273 of which were conventional farms, 112 organic farms, and 4 farms were engaged in biodynamic agriculture). Subsidies, Total Costs, Operating Revenue, Profit and Gross Value Added indicators were selected for evaluation. The individual indicators within groups of companies were compared by means of a *t*-test. The analysis revealed significant differences in the economic indicators of individual types of farms. It was observed that organic enterprises have better economic results than conventional and biodynamic businesses. Subsidies help all types of farms achieve better results. We may hence assume dependence of these farms on subsidies.

agriculture; economic situation of farms; subsidies; *t*-test



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INTRODUCTION

The aim of the organic agriculture is to create ‘a sustainable production system with a capacity to sustain and protect nature and the landscape, as well as to minimize environmental damage induced by existing agricultural practices’ (Oxouzi, Papanagiotou, 2010).

The number of organic farmers in the Czech Republic has been constantly increasing. In 1990 there were only 3 organic farms in the Czech Republic, one year later the number grew to 130, in 2000 the number of organic farmers exceeded 500, and in 2013 altogether 4060 organic farmers were registered whose total area of agricultural organic land amounted to almost 500 000 ha. The share of organically farmed land on the soil fund of the Czech Republic is 11.68% (Ministry of Agriculture of the Czech Republic, <https://eagri.cz/>). The Czech Republic thus ranks among countries with the highest share

of organically cultivated land in the EU and globally (Eurostat, <http://ec.europa.eu/eurostat>; Faostat, <http://faostat.fao.org/>).

A specific type of agriculture is biodynamic agriculture, which is governed by specific conditions issued by the Demeter-International (Demeter, 2014) and meets the requirements of organic farming. Biodynamic agriculture originated in 1924 as a response to the deteriorating state of soil and food in connection with the intensification of agriculture. The founder of biodynamic agriculture was Rudolf Steiner (Steiner, 2004; Paul, 2011). It differs from organic agriculture in its use of special biodynamic agents.

In 2014 the area of 156 000 ha of agricultural land was cultivated by more than 4900 certified biodynamic businesses out of which almost 1500 are located in Germany (Demeter, 2014), i.e. more than one half of biodynamic farms of the EU. In the Czech Republic, there are four biodynamic farms holding the Demeter certificate.

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In previous years a number of authors were engaged in comparing different types of agricultural methods, especially those of organic and conventional farming. Demiryurek, Ceyhan (2008), Brožová (2011) or Sgroi (2015) explored the economic situation of organic farms based on financial analysis indicators and they compared the results with conventional farms. The role of supporting the financial situation of organic farms was examined by Gay, Offermann (2006) and Offermann et al. (2009). Questions about the negative impact on markets and prices were discussed by Nieberg, Kuhnert (2007).

McCroory (2001), Connolly (2002), Moudry (2005), Kouřilová (2010) and others dealt with the evaluation of efficiency of organic farms and their differences compared to conventional agricultural enterprises. Madau (2007) and Kumbhakar et al. (2009) confirmed lower technical efficiency of organic farms compared to conventional farms. According to Kroupová, Malý (2010) agricultural enterprises involved in organic farming are dependent on subsidies. Moreover, subsidies have a negative impact on the economy of these businesses.

Technical efficiency of biodynamic farms and the impact of subsidies on the production ability in the Czech Republic were studied by Pechrová, Vlašicová (2013).

Despite its long existence, biodynamic agriculture has not been sufficiently examined from the economic viewpoint so far. The aim of this study is to evaluate and compare the economic situation of biodynamic, organic, and conventional farms. It is a very specific issue filling in the gap namely in the area of economic research of biodynamic agriculture. The authors assume close similarity of economic results of organic and biodynamic farms and at the same time different economic results of these farms compared to conventional farms.

MATERIAL AND METHODS

Data were gathered from Albertina database administered by Bisnode, the Register of Organic Farmers administered by the Ministry of Agriculture of the Czech Republic, further from Demeter-International, which associates and certifies biodynamic farmers, and finally from the Register of Recipients of Subsidies administered by the Ministry of Agriculture of the Czech Republic.

For the analysis, we gathered data from 389 Czech agricultural enterprises that according to the Ministry of Agriculture were receiving subsidies from the EU or state subsidies from the Czech Republic between 2007 and 2012. Out of the total number, 273 were conventional farms, 112 organic farms, and 4 examined businesses were biodynamic farms.

The following indicators for the analysis were chosen: Subsidies (SUB) representing the sum of subsidies received by enterprises in a given year from the EU or the Czech government, Total Costs (TC), Operating Revenue (OR), Profit (PROF), and Gross Value Added (GVA). All indicators were calculated for particular groups of enterprises – conventional farmers (C), organic farmers (O), and biodynamic farmers (B) and for better interpretation these indicators were further recalculated per 1 hectare of agricultural land (hereinafter referred to as ha).

Normality of distribution for each indicator was verified by the Shapiro-Wilk test. The division of the data was normal. The Levene's test for assessing the equality of variances was used. An independent *t*-test on 5% statistical significance was used for comparison the mean values of individual indicators among the conventional, organic and biodynamic enterprises (see Meloun, Militký, 2012).

RESULTS

We tested 5 economic parameters (Subsidies – SUB, Total Costs – TC, Operating Revenue – OR, Profit – PROF, Gross Value Added – GVA) within 3 groups of agricultural businesses (Conventional – C, Organic – O, and Biodynamic – B) and we received 15 pairs that were tested based on their equality of mean values. The first part of Table 1 shows the basic statistics of the indicators, while the second one shows the results of the *t*-test.

The zero hypothesis of equality of the mean values was rejected for the tested parameters of particular groups with the exception of two pairs tested. The amount of received subsidies per ha does not significantly differ between organic and biodynamic agricultural enterprises (pair O_SUB and B_SUB). It is given by identical aid schemes from which both groups of businesses can benefit, because, as stated above, biodynamic farming also meets the requirements of organic farming.

The zero hypothesis was further confirmed for pair C_PROF and O_PROF where we compared the amount of profit between conventional agricultural businesses and organic agricultural businesses. Although the mean values of this pair's profits differ by 1830 CZK/ha, the difference is not statistically significant.

The differences between the indicators values of particular groups of agricultural businesses (C, O, B) are shown in box plots in Fig. 1. The highest values within the subsidy parameter are achieved by biodynamic farmers whose subsidies during the monitored period ranged from 11 000 to 18 000 CZK/ha. Similar yet somewhat lower values are also achieved by farmers focusing on organic agriculture (10 000–16 000 CZK/ha). On average, conventional farms show by 5000 CZK

Table 1. Results of the *t*-test

Indicator	Mean	SD	SEM	Mean Diff.	SEMD	95% CID		t	P-value
						Lower	Upper		
C_SUB	9.40	1.50	.61	-3.38	.95	-5.50	-1.26	-3.55	.01
O_SUB	12.78	1.79	.73	-1.59	1.29	-4.47	1.29	-1.23	.25
B_SUB	14.37	2.61	1.07	-4.96	1.23	-7.70	-2.23	-4.04	.00
C_TC	109.15	7.56	3.09	71.91	3.69	63.70	80.12	19.51	.00
O_TC	37.23	4.94	2.02	29.50	2.05	24.32	34.67	14.42	.00
B_TC	7.74	.83	.34	101.41	3.10	93.49	109.33	32.67	.00
C_OPR	111.11	8.16	3.33	69.31	4.13	60.11	78.51	16.79	.00
O_OPR	41.81	5.97	2.44	34.90	2.46	28.65	41.15	14.18	.00
B_OPR	6.91	.86	.35	104.21	3.35	95.65	112.77	31.10	.00
C_PROF	2.92	1.81	.74	-1.83	1.08	-4.24	.58	-1.69	.12
O_PROF	4.75	1.94	.79	4.35	.81	2.32	6.37	5.35	.00
B_PROF	.41	.47	.19	2.52	.76	.62	4.41	3.30	.02
C_GVA	16.60	1.49	.61	12.05	.98	9.87	14.23	12.34	.00
O_GVA	4.55	1.87	.76	5.05	.79	3.09	7.01	6.36	.00
B_GVA	-0.50	.54	.22	17.10	.65	15.54	18.67	26.44	.00

SD = standard deviation, SEM = standard error of the mean, Mean Diff. = mean difference, SEMD = standard error of the mean difference, 95% CID = 95% confidence interval of the difference; source: own processing

lower subsidies per ha than biodynamic farms and by 3500 CZK lower subsidies per ha than organic farms.

Except for minor fluctuations, indicators of costs and revenues have a constant progression for all analyzed groups of enterprises. The highest total costs are shown for conventional farms (Fig. 1). Their average total costs per ha are around 109 000 CZK. The lowest total costs per ha are shown for biodynamic farms (approximately 8000 CZK/ha). The average total costs of organic farms are 37 000 CZK per ha. When more closely analyzing the costs, we can see that the production consumption is reflected in the total costs of enterprises in 50–70%. It means that the ha costs of consumption of material, power,

and services is 62 000 CZK for conventional farms, 20 000 CZK for organic farms, and 5 500 CZK for biodynamic farms. The lowest labour consumption in relation to total costs is shown by biodynamic farms; their labour costs are reflected in the total costs only in 5% on average (i.e. approximately 360 CZK/ha). Labour costs of conventional farms oscillate around 13% of total costs (i.e. 15 000 CZK), while organic farms consume 18% of total costs on labour costs (i.e. just under 7000 CZK/ha).

Conventional businesses have the highest revenues of the surveyed companies (on average 111 000 CZK per ha); their revenues are almost 16 times higher than those of biodynamic farms (less than

7000 CZK/ha). The average revenues of organic farms are 42 000 CZK/ha. Although organic farms do not have the highest revenues, they are able to generate the highest profit. Their average annual profit is 4800 CZK per ha. Like in the case of conventional farms, the Profit indicator of organic farms has a growing character. In the last monitored year, organic farms reached profit of approximately 7700 CZK/ha. The average profit of conventional farms was around 3000 CZK/ha; in 2012, the monitored conventional farms achieved the average profit of 5600 CZK/ha. The lowest profit is reported by biodynamic farms. The character of the time series of the indicator fluctuates; the highest profit was achieved by biodynamic farms in 2010 and 2012 (922 CZK/ha, 809 CZK/ha, respectively); in 2008 and 2012 they reported loss (-53 CZK and -218 CZK/ha). In the monitored period, biodynamic farms reported a profit averaging 408 CZK/ha. Conventional farms again have the highest added value per ha (almost

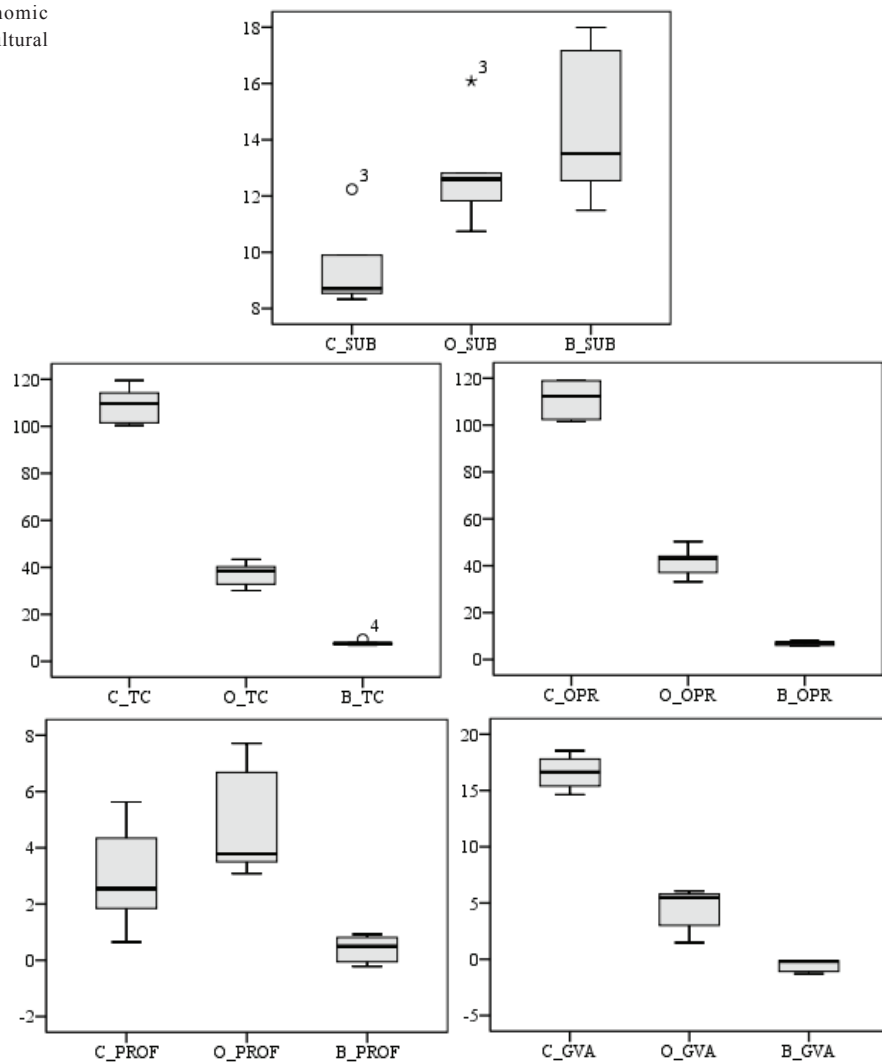
17 000 CZK/ha on average). Biodynamic farms, however, annually reported negative added value (-500 CZK/ha on average). The average added value of organic farms was around 5500 CZK/ha.

Conventional farms are unable to cover their production consumption and personal costs by the generated production, which indicates that subsidies can represent an important factor affecting the economic result of these businesses.

Organic farms are able to cover their production consumption by the generated output. Nevertheless, if we add personal expenses, then these costs exceed the generated production. There is a clear effect of subsidies that help these businesses achieve better results. When including the sum of received subsidies, production can cover the production consumption and personal expenses.

The stabilizing effect of subsidies is also evident in biodynamic farms whose sales are very low compared to production consumption and personal expenses.

Fig. 1. Box plots of the analyzed economic parameters according to groups of agricultural enterprise



source: own processing

These companies are unable to pay the incurred costs by their production and subsidies greatly help them in improving their economic situation. Hence we can assume dependence of biodynamic farms on subsidies.

DISCUSSION

The economic situation of organic farmers (but not biodynamic farmers) is more favourable than the economic situation of conventional farmers. We achieved similar conclusions as Nemes (2009), Brožová (2011), Delbridge et al. (2013) or Sgroi et al. (2015). However, without the possibility of receiving subsidies, these businesses would not have achieved such results, because their production is not able to cover consumption. On the contrary, Oxouzi, Papanagiotou (2010), who studied agriculture in Greece, came to opposite conclusions. Nevertheless, according to Nieberg, Offermann (2003), the average profits of organic farms in Europe are similar to those of conventional farms.

Organic farms gain higher subsidies than conventional farms (see also Gay, Offermann, 2006). In addition to basic subsidies, which are intended for agricultural enterprises, organic enterprises (as well as biodynamic enterprises) may also apply for a higher amount of subsidies than conventional businesses, in particular the support for organic farming. The subsidies for organic farmers are intended to compensate for the higher positive externalities induced by organic farming in comparison with conventional agriculture, and to pay for internalization of negative externalities. Due to the existence of positive externalities a lower quantity of goods is produced than what is required for social welfare (Soukupová et al., 2004; Kroupová, Malý, 2010).

Offermann, Nieberg (2000) explored the factors affecting the conversion of agricultural enterprises from conventional to organic type of farming. Their study proved that the achieved profit is a major factor of the conversion. Because the evaluated organic farms achieve the highest profit per ha of all the examined types of farms, this type of agricultural technology may be recommended as suitable for conversion from conventional farming. On the other hand, based on the profit factor, biodynamic technology can be assessed as unsuitable for conversion.

Lobley et al. (2009) say that most of the differences between organic and non-organic farms do not stem directly from differences in farming systems but, rather, reflect considerable differences in the people who operate organic. Simply comparing organic and non-organic farms is too blunt an approach. It is important to consider other factors such as the type of enterprises, marketing routes, etc.

CONCLUSION

The performed statistical analysis has highlighted the differences in the financial management of various types of farms in the Czech Republic. Conventional farms achieve higher values of input and output indicators. Organic farms achieve the second highest value of cost and revenue indicators and show the highest profit among the analyzed farms.

Although biodynamic farms meet the conditions of organic farming, their economic results significantly differ from those of organic farms. Biodynamic farms can be considered as the least economically efficient. Their costs in some years exceed the revenues and businesses report loss despite the fact that they receive the highest sums of subsidies.

In general we can say that enterprises engaged in organic agriculture are in a better economic situation than companies involved in biodynamic farming and conventional farming.

Based on the comparison of generated production with production consumption and personal expenses, it was found that all three groups of farms are not able to cover their costs by the generated output. Subsidies help them achieve better results and hence we can assume their dependence on subsidies. However, this statement has not been statistically verified and therefore there is still potential for further research.

Economic research of biodynamic farms has so far been performed only on 4 samples from the Czech Republic and therefore it is a future challenge to analyze data of these businesses in other countries and compare the results with the Czech Republic and develop proposals of measures for improvement of the current situation of the Czech biodynamic farms. Any further research in biodynamic agriculture will help enhance the information base about this unconventional method of agriculture.

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