Cost and profit Analysis of Organic and Conventional Farming in Hungary

Ökológiai és konvencionális gazdálkodás költség-jövedelem elemzése Magyarországon

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ABSTRACT

The object of this analysis was to compare the organic and the conventional farming on the basis of primer database and modeling at the location of Hortobágy that is a well-known organic farming region in Hungary. 20 model variations were worked out for the conventional and 20 for the organic farming situation. According to the results, there is no significant difference considering the costs per hectare in the two modeled farming methods, although the structures of the production costs show huge deviations. The cost per production unit is typically higher in the organic model. Considering most of the model variations, organic farming is proved to be more profitable, but this economic pre-eminence is not explicit by any means.

KEYWORDS: organic farming, conventional farming, cost and profit analysis

ÖSSZEFOGLALÁS

Elemző munkánk célja az volt, hogy a Hortobágy térségében végzett, primer adatgyűjtésen alapuló modellezés segítségével összehasonlítsuk az ökológiai és a konvencionális gazdálkodást. Összesen húsz-húsz modelvariációt dolgoztunk ki a két gazdálkodási módra. Eredményeink alapján nincs jelentős különbség a két gazdálkodási mód között az egy hektárra jutó termelési költségben, ugyanakkor a termelési költség szerkezete jelentős eltérést mutat. Az ökológiai gazdálkodásban az önköltség általában magasabb. A legtöbb modellvariációban az ökológiai gazdálkodás jövedelmezőbbnek bizonyult, de ez a gazdasági előnye nem egyértelmű.

KULCSSZAVAK: ökológiai gazdálkodás, konvencionális gazdálkodás, költség-jövedelem elemzés

DETAILED ABSTRACT

Vizsgálataink célja az volt, hogy az ökológiai és a hagyományosnak tekinthető, kemikáliát, műtrágyát is felhasználó (konvencionális) gazdálkodást termelői adatgyűjtésre alapozott modellszámítások alapján összehasonlítsuk. Adatgyűjtésünk a Hortobágy – Faluvéghalma – Ohat – Újszentmargita települések által körülölelt területen történt, ennek termelési adottságait, gazdálkodási gyakorlatát, vetésszerkezetét (*1. táblázat*) vettük figyelembe a modellezéskor. Az egyes modellváltozatok összehasonlítása – a technológiák, hozamok és árak mellett – kiterjedt a vállalkozó munkadíját nem tartalmazó költségekre, az önköltségre, a támogatásokra, valamint a bruttó jövedelemre. Az egy hektárra jutó költségek összegében a két gazdálkodási mód között jelentős eltérések nem alakultak ki (*2. táblázat*), a költségek szerkezete azonban markáns különbségeket mutatott (*1. ábra*), amely a két gazdálkodási mód technológiai eltéréseivel magyarázható. A növénytermesztés valamennyi vizsgált ágazata esetében magasabb önköltség mutatkozott az ökológiai gazdálkodásban (*3. táblázat*), viszont a juhtartás esetében ez a gazdasági hátrány elmaradt. Az összefogott és szervezett, elsősorban exportpiacokon történő termékértékesítésnek köszönhetően, az ökológiai gazdálkodásban realizálható magasabb termékár általában ellensúlyozta a konvencionális gazdálkodásban elérhető magasabb hozamokat, de egyes évek hozam- és áradatai mellett fordított helyzet is kialakulhat. A modellváltozatok többségében, a támogatási szinteket is figyelembe véve (*4. táblázat*), az ökológiai gazdálkodás összességében jövedelmezőbbnek bizonyult, bár ez a gazdasági fölény a vizsgált tényezők változásától jelentős mértékben függ (*1. melléklet*).

INTRODUCTION

Organic farming in Hungary, following the Western-European “green” trends of the past 15 years, developed dynamically from the mid 1980s ([2]) till 2004. Then, the size of organic land and the number of organic farmers turned to decrease *([4,11])*. To understand this phenomenon, analytical studies on cost and profit conditions, comparing organic farming with the other, basically conventional one, would be essential.

In the last 10-15 years, the topic of organic farming was discussed in larger volumes in the scientific literature than the level the economic performance of this farming method justified. The reference literature quite agrees on the yield, price, cost and profit trends of organic and conventional agricultural systems. The authors (e.g. 9, 6, 5, 10) suggest that organic farming goes together with low levels of pre-harvest yields. Nonetheless, the researchers intentionally avoid making the claim that organic methods routinely outperform conventional systems ([9]). The difference in yields can significantly depend on the crop system itself ([1]). Furthermore, the decrease in yields can even turn into an increase after the conversion period ([3]). In many cases the scientific comparison of the two farming systems can be questioned as data coming from different sources are often in contradiction with each other.

Only few studies can be found on sector-specific cost and profit analyses of organic farming in Hungary, and analyses on the comp arison of organic and conventional farming methods are even less common.

MATERIALS AND METHODS

During primary data collection special emphasis was put on the fact that the modeled farms should have same features in production sites and farming conditions. Data collection was done in the area of Hortobágy, at Faluvéghalma, Ohat and Újszentmargita settlements. Private farms dealing with arable farming and animal husbandry were considered as basic population for the sample of the present analysis. Typical arable crops in the area include winter wheat, spring barley, rye, sorghum, sunflower, rape, peas and alfalfa. Animal breeding concentrates mainly on ewe and cattle breeds; fodder-based animal husbandry is not significant. The data collection was carried out by asking producers to fill in a datasheet. Beside the general characteristics of farming data collection focused on technologies, purchases and sales, asset supply and information on overhead costs. Altogether 28 producers filled in the datasheet, of which 22 were appropriate for evaluation. On the basis of professional considerations, 4 typical ecological farms and 4 typical conventional ones were selected with the following aspects: the production structure is similar in the farms, their production standards are acknowledged by local experts and the ecological farms are farms already converted to organic technologies.

The average farm size of the organic sample is 58 hectares. Beside winter wheat (30%) and sunflower (18%), alfalfa, barley, oat, pea and mustard are continuously present in the crop structure. Two farmers of the four keep Hungarian merino on grassland in 0,4 livestock unit density. The average farm size of the conventional sample is 76 hectares. Beside winter wheat (55%), sunflower (20%), barley, mustard are present in a great proportion in the crop structure. Three of the conventional farms deal with conventional sheep husbandry. Every farm in the sample bases its operation on family labour, but hire external labour for certain seasonal works (e.g. sheep shearing).

Data were evaluated in a detailed way, the most common practices were taken into consideration relating to characteristics of farms as well as technological processes (e.g. machinery connections of field operations), and in the case of data to be averaged (e.g. yields) the weighted arithmetical mean was calculated. The models created were built on these features. When compiling the model, the principle *ceteris paribus* was followed to the greatest degree; the two-farm model contains differences which are only compulsory consequences of the different farming methods (technologies, prices, subsidies, extra costs of controlled production etc.).

The sizes and production structures of the two model farms are the same, as well as their natural conditions. The size of arable land is 40 hectares of rather poor quality (the per hectare Golden Crown-value is only 11); half of it is rented. On the grassland of 20 hectares being partly rented, (of even lower quality, the per hectare Golden

Crown-value being 4) the average number of ewes is 50 animals (with milking lambs being sold). The crop rotation recurring in 8 years is the same in the two models. As the structures of the produced crops are different in certain years (Table 1), and these influence the revenues and the costs, the models were developed for seven years in accordance with the seven-year-cycle of the crop rotation in a way, that prices and subsidies of sample farms, based on the data collected from producers, were considered the same within one model variety. This arrangement facilitated the analysis of a seven-year-period assuming the same price and subsidy conditions.

Table 1. Crop rotation and annual cropping structures in the model

year	Parcel (4×10 ha)			
	1.	2.	3.	4.
1.	Sunflower	Alfalfa	Winter wheat	Pea
2.	Peas	Alfalfa	Mustard	Winter wheat
3.	Winter wheat	Alfalfa	Oats	Mustard
4.	Mustard	Alfalfa	Peas	Oats
5.	Oats	Sunflower	Winter wheat	Peas
6.	Peas	Spring barley	Sunflower	Winter wheat
7.	Winter wheat	Winter wheat	Peas	Sunflower

To determine the sum of the subsidies, the year of 2007 was chosen; but this year was not a usual year considering the yields and prices, so we created 4 organic and 4 conventional model variations based on yields and prices of different years in the following way:

A: average yields of the years of 2005 to 2007, prices of the year of 2007; B: yields and prices of the year of 2006; C: yields and prices of the year of 2007; D: yields and prices of the year of 2008.

The model variations are identified with letters. The first one refers to the farming method (O = organic; C = conventional), the second one (A, B, C, D) refers to the model variation based on the yields and prices. For example „OD” refers to the organic model based on the yields and prices of the year of 2008.

Each of the model variations was calculated on 5 subsidy levels, so the total amount of the model variations is 20 for the organic and 20 for the conventional farming. The five subsidy levels are the following:

I. No subsidy;

II. SAPS plus national TOP-UP level;

III. SAPS plus national TOP-UP level plus LFA;

IV. SAPS plus national TOP-UP plus the subsidies of the Agri-environmental Program:

- in the conventional model, the basic-level programs for the arable land and grassland.
- in the organic model, the organic arable land and the organic grassland programs.

V. SAPS plus national TOP-UP plus the subsidies of LFA plus the subsidies of the already listed Agri-environmental Programs:

Beside yields, prices, the technologies the 20-20 model varieties were compared from the aspect of non-labour costs (all costs without the wages due to the entrepreneur, but containing the cost of the required external labour), non-labour production cost per unit (area or animal), subsidies as well as gross profit (including the wage due to the entrepreneur). The gross profit was calculated as the revenue containing subsidies minus non-labour costs (including overhead costs). The deviations of gross profit were divided among the effects of five factors by chain substitution, in the following way: the starting point in every model variety was the gross profit in the conventional farm, and then the data of factors influencing the gross profit of the conventional farm were substituted by the relevant data of the ecological farms step by step. The Five Factors considered were:

C: *Capacity* – number of ewes (item), field size (hectare). These are the same at each subsidy levels, except for subsidy levels IV and V, due to the AEM national rules that require a given size of “organic compensational territory” in the case of organic arable land AEM program, and because of this, grass boundaries of 8 percentages of the parcels were calculated in the organic farming model.

Y: *Yield* (amount of products per ewe or hectare, in natural measurement units).

CU: *Cost per production unit, defined as direct plus overhead costs minus labor costs* (HUF/kg, HUF/t).

P: *Market price* (HUF/kg, HUF/t).

S: *Subsidies* (HUF/ewe, HUF/ha).

Then gross profit (GP) is computed in the following way:

GP = (CÍYÍP)+(CÍS)-(CÍYÍCU)

The applied calculations are exactly the same as those in most of the relevant analytical methodology literature *(for example 7, 8)* the only difference is that our data cover more than one product or one year, so the calculations are applied for the period of 7 years of the crop rotation, while the product is the sum of the outputs of the individual years . It must be mentioned that this process requires an uncomparable amount of calculations.

RESULTS AND DISCUSSION

Taking the costs per ewe or hectare into consideration, there are no significant differences between the two modeled farming methods (Table 2). An advantage of more than 10 % for conventional farming is found only in winter wheat production at the first three subsidy levels. The most remarkable cost differences are shown in pea and barley production to the advantage of organic farming; however, these differences do not exceed 15-16 percentages at any of the subsidy levels.

Table 2. Costs per ewe or hectare in Model BA

Model, measurement unit	Sector	Subsidy level I.	II.	III.	IV.	V.
BA, HUF	Sheep k.	25022	25031	25504	27987	27987
	W. wheat	150734	150931	151908	143995	143995
	Sunflower	128479	128677	129664	123462	123462
	Alfalfa	98334	98533	99274	96413	96413
	Pea	137785	137982	138790	132021	132021
	Barley	109235	109435	110433	105754	105754
	Oat	118471	118669	119656	114263	114263
	Mustard	115884	116083	116727	111787	111787
BA/KA, %	Sheep k.	97	97	99	102	102
	W. wheat	111	111	111	104	104
	Sunflower	103	103	103	97	97
	Alfalfa	98	98	98	94	94
	Pea	89	89	89	84	84
	Barley	89	89	89	85	85
	Oat	98	98	98	93	93
	Mustard	107	107	107	102	102

In winter wheat production, material costs per hectare are the same in the two modeled farming methods, because the costs of chemicals and artificial fertilizers in conventional farming are balanced with the costs of soil and plant conditioning materials in organic farming as well as the more expensive organic seed used in the latter one. The extra costs of organic winter wheat production is basically caused by the extra machinery costs that are partly covered by the more precise seedbed preparation and partly by the mechanical weed control. In the case of conventional barley production, the extra cost is largely explained by the higher level of material costs (costs of fertilizers and chemicals). The cost per hectare of pea silage in conventional farming is higher because of the extra material costs (fertilizer, larger amounts of bale-net due to higher yield levels) and extra machinery costs (fertilization, extra baling).

However, there are no significant differences in costs per ewe and hectare considering the two farming methods while there are excessive differences in cost structures and costs per production unit. Figure 1 focuses on the effects of tehnological differences for the production costs in the case of barley production. It is clear that the soil preparation cost is higher in organic farming due to the more precise seedbed preparation. In conventional farming, the higher level of fertilization costs is explained by the use of chemical fertilizers, while the higher level of plant conditioning costs is due to the different type of chemicals used. The differences in costs displayed in Figure 1 cannot be taken common or typical. For example, in winter wheat production it was already discussed that the costs of chemical fertilizers and other chemicals can be balanced with the mechanical weed control and the application of permitted soil and plant condition materials.

Figure 1. Costs per hectare in barley production (Models BA and KA)

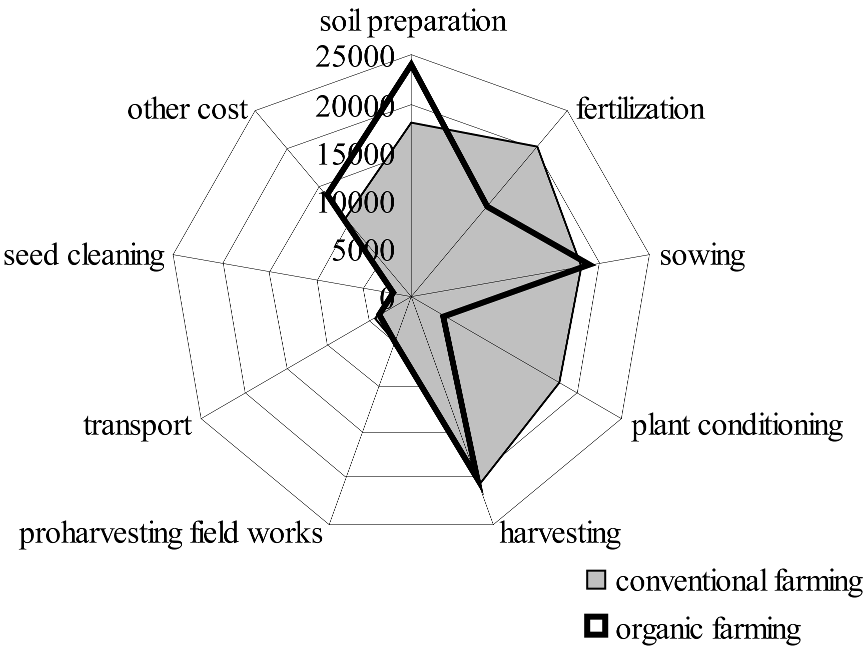

Table 3 summarizes and compares the average costs per production units of the conventional and the organic models A to D. It seems to be obvious that all the organic products have a high level of cost per production unit, and this is evidently cannot be explain by the organic farming method itself, but it is also a result of poor natural resources, soil conditions, and farming size.

Table 3. Cost per production unit minus labor cost at the average of models A - D me.unit: HUF/kg for lamb, HUF/t for crops

Farming method	Product	Subsidy level I.	II.	III.	IV.	V.
Organic	Lamb	1113	1114	1136	1252	1252
	W. wheat	46719	47013	47120	48663	48663
	Sunfower	120205	120391	121314	125557	125557
	Alfalfa	15152	15183	15297	16148	16148
	Pea	13287	13306	13384	13838	13838
	Barley	44906	44994	45434	47427	47427
	Oat	46362	46446	46865	48790	48790
	Mustard	136808	137042	137803	143446	143446
Organic by the percentage of conventional one	Lamb	97	97	99	102	102
	W. wheat	132	132	132	135	135
	Sunfower	109	109	109	112	112
	Alfalfa	101	101	101	106	106
	Pea	112	112	112	115	115
	Barley	103	103	103	107	107
	Oat	110	110	110	114	114
	Mustard	121	121	120	125	125

There is no significant difference in the production costs per ewe considering the two analyzed production methods, and this is what can be expected, because of the similar production technologies. Taking the cultivation into consideration, the cost per unit of each of the crops is higher in organic farming. The most remarkable difference appears for the winter wheat (32-35%), however, the “extra organic price” is also the highest for this crop. According to these results, it seems possible to meet the higher level of costs per hectare (good quality of seeds, seedbed preparation, mechanical weed control, and soil and crop condition materials) even with relatively low level of yields achieved. There is also a significant difference (20-25%) in the case of mustard, where the costs per hectare are higher by only a few percentages in organic farming, but the yield per hectare is much lower. In pea silage production, the cost per production unit is higher by 12-15 percentages in organic farming, and this reflects the fact that the more than 20-percentage yield loss overcompensates for the 10-15-percentage lower costs per hectare.

Table 4 identifies the significance of subsidies in both of the models. According to data in Annex 1 none of the farming methods seems to be viable without subsidies. In models BA and BC, the gross profit is positive even without subsidies, but still quite low, not even covering the minimum wage of the agricultural entrepreneur. The ratio of subsidies in the total income of the entrepreneur is 24 to 30 percentages even at the lowest subsidy levels, and it is as high as about 50 percentages at the highest subsidy level. The variations in gross profit cannot mainly be explained by the subsidy system.

Table 4. Ratio of subsidy within the total income (%)

Model	Subsidy level				
	I.	II.	III.	IV.	V.
KA	0	25	33	36	41
KB	0	30	38	41	47
KC	0	27	35	38	43
KD	0	26	33	36	42
BA	0	24	31	37	42
BB	0	29	37	44	49
BC	0	24	32	38	44
BD	0	26	34	40	46

The summarizing table of chain substitution analysis (Annex 1) reflects that variations in capacities and subsidies explain only a small part of the differences in gross profits, and only at subsidy levels IV and V. Note that at these subsidy levels there are smaller field sizes (because of the already mentioned grass boundary) and a difference in subsidy amounts (“basic level” AEM program for conventional, organic AEM program for organic model). The positive values in the “capacity” column show that the decrease of field size results in the increase of gross profit, with costs per production unit higher than market price (ceteris paribus).

Most of the differences in gross profit are the results of the differences in product amount per hectare, the cost per product unit and the market prices. As it was explained earlier, there are no significant differences considering the costs per hectare between the modeled farms, the variations in costs per production units are mainly the results of differences in yields. So the variations in gross profit are basically influenced by the conventional “extra yield” and the organic “extra price”. It can be seen that the effect of organic “extra price” was stronger in models “A”, “B” and “C”, and, on the other hand, in model “D”, using yields and prices of the year 2008, the “extra price” cannot balance the disadvantages in yields and costs per production unit in the organic farm. Considering most of the models, organic farming seemed to be more profitable; however, its economic advantages could not be easily recognized.

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Annex 1. Summary table of the chain substitution analysis me.unit: thousand HUF

Model	Subsidy level	Gross profit of conventional farming	Effects of the variations in the five factors on gross profit (±)					Gross profit of organic farming
			Capacity	Yield	Cost per unit	Market price	Subsidy	
	I.	-211	0	-63	-538	1145	0	334
	II.	1588	0	-62	-546	1146	0	2125
A	III.	2383	0	-58	-554	1146	0	2916
	IV.	2635	-11	-51	-682	1054	237	3181
	V.	3439	-11	-51	-682	1054	237	3985
	I.	-1354	0	64	-667	815	0	-1142
	II.	445	0	65	-673	815	0	652
B	III.	1239	0	70	-684	815	0	1440
	IV.	1491	81	67	-803	750	237	1823
	V.	2295	81	67	-803	750	237	2627
	I.	-593	0	-21	-401	1084	0	69
	II.	1201	0	-20	-404	1084	0	1861
C	III.	1996	0	-17	-411	1084	0	2652
	IV.	2248	20	-14	-549	997	237	2939
	V.	3052	20	-14	-549	997	237	3743
	I.	-320	0	-69	-812	794	0	-407
	II.	1482	0	-68	-821	794	0	1387
D	III.	2277	0	-61	-834	794	0	2176
	IV.	2529	-2	-53	-941	730	237	2499
	V.	3333	-2	-53	-941	730	237	3303