

EFFICIENCY OF AGRICULTURAL PRODUCTION WITHIN THE CONVENTIONAL AND ORGANIC FARMING

J. MOUDRÝ, Jr.¹, P. KONVALINA¹
J. MOUDRÝ¹, D. KOPTA², J. ŠRÁMEK¹

¹ University of South Bohemia, Faculty of
Agriculture, České Budějovice
e-mail: JMoudry@zf.jcu.cz

² University of South Bohemia, Faculty of Economy,
České Budějovice

Yield height is one of the most evident differences between conventional and organic farming. Yield differences predominantly depend on the crop species and the major drop in yield within the organic farming comes in the period of conversion, lower variability feature low-input species. Combination of factors defines overall yield distinction between conventionally and organically grown crops. Within the organic farming systems cost minimisation has still continued concerning for example leaving out intensification inputs and several cultivation operation (biocides application, fertilizer application - decrease by 60-100%). On the other hand there are several cost items rising (higher need of labour - rise by 10-20%). And again these differences depend on many factors - crop plant, cropping pattern system, locality, etc.. Another aspect of organic farming production efficiency consists in higher prices compared to conventional production prices. Price diversity varies with dependence on particular crop types. Although yields of crop within the organic farming systems do not reach such an intensity compared to conventional farming, the effect of agricultural subsidies, higher prices of bioproduct and overall lower cultivation costs can make the organic farming as same effective. Under suitable conditions the efficiency of organic farming could be even higher.

Key words: Yield, Costs, Organic farming, Conventional farming, Efficiency,

Taking into account that organic farming is very often carried out in LFA areas (Less Favourable Areas), it is necessary to pay attention to production efficiency of enterprises farming in these areas. According to (Šroller et al., 2001) yield can be considered to be the limit of marginality, when at least zero rentability of production is reached and average products sale is realized. Limit of marginality for plant production largely varies with dependence on the particular crop, agricultural production prices, yields and production costs (Brabenec, 1996). When determining the structure of agricultural management systems it is important to evaluate and quantify yield potential of marginal areas so as the rentability limits for selected crop production and overall economic results of the management system could be stated. (Šroller, Šimon, 2000). In the Czech Republic the share of LFA represents 45% of agricultural land (Kvapilík, 1996), however the differences

between costs and revenues in both, organic and conventional farming, have to be monitored in production areas as well. Střeleček et al. (2000) defines these areas as areas with elevation below 450 m a. s. l..

In these areas plant production can be optimised using suitable crop rotation with proper crop diversity (Šroller et al., 2001). Vrkoč et al. (1996) state that crop rotation structure plays more important role compared to fertilizing, variety selection and similar factors when the economic results are considered. For example in submontane regions with elevation 300 to 600 m a. s. l. cereal crops (wheat, rye triticale above all) can be grown, also for industrial purposes (ethanol, starch production), using the economy method (Tichý, 2001). Also Moudrý, Pokorný (1999) mention rye and triticale to be the suitable crops for such purposes. Consequently, differences in economic efficiency between organic and conventional farming systems can be partially compensated when suitable crops are used.

Within organic farming there are different relations between yields and costs compared to conventional farming. In general in organic farming yields per area unit are lower, costs per production unit are higher and costs per area unit are lower. Higher prices of bio-products compensate for lower yields. Relation between yields, costs and prices varies in accordance with particular crop (commodity) and limit suitability of such crop for organic farming system. On a case-to-case basis there are many differences resulting from an enterprise ability to minimise production investments, maximal mechanisation exploitation, labour costs and to overcome the production depression from the period of conventional-to-organic farming conversion.

MATERIAL AND METHODS

The analysis of agricultural production efficiency itself was carried out using a file of 57 farming enterprises located in production and submontane regions (elevation 350 - 1100 m a. s. l.) in South and West Bohemia. From this file 33 enterprises apply conventional farming principles and 24 subjects use organic farming principles. The data was collected by means of questionnaire survey and direct interviews in site. As the relevant information were chosen yields of selected crops in year 2005 and assessment of technological practices. Potatoes, wheat, rye, triticale were used for detailed analysis. To provide comparability of information technological and variable cost according to selected crops within conventional and organic farming principles were calculated using Standards of agricultural production technologies. Cost items were taken over and modified according to Kavko (2006).

RESULTS AND DISCUSSIONS

Yield differences of crops within conventional and organic farming systems

When an agricultural enterprise adopts organic farming system the beginning of such conversion is the critical period. Yields on arable land dramatically decrease by 30-50 %. Less significant drop of yield can be expected in locations

with natural soil fertility, the more flexible and low-demanding the plants are, the lower the inputs (production intensity) before conversion were. Yield decrease will be closely dependent on crop rotation modification (share of legumes, “curative” crop species) and the way and intensity of barnyard manure application. The most intensive yield reduction can be expected in situation when disallowed principles and materials are given up without being replaced by adequate inputs or measures within the overall system harmonisation. The basis of sustainable and adequately high production lies in going nutrient and energy cycle on a farm. Organic farming should be focused on commercial crops that are minimally affected by yields reduction (rye, oat, spelt, buckwheat) or on such principles where cost savings exceed earnings reduction.

Table 1

**Yields achieved within organic farming expressed as a percentual share of reference commercial yields in particular countries
(Modified according to Urban, Šarapatka at al. 2005)**

	AT	DE	FI	FR	GB	IT	LU	NL	CH	NO
Wheat	62-67	58-63	45-74	44-55	46-61	78-98	51	69-77	65-74	76
Rye	65-85	60-62	61-94	-	-	-	66	77	62-94	-
Oat	56-75	-	53-75	-	61-83	88	61	64	73-94	80
Potatoes	39-54	54-69	86-121	68-79	38-82	62-99	53	58-83	62-68	100

After conversion to organic farming principles yields of cereal crops stabilize on 60-80 % in comparison to conventional farming. The difference rises with dependence on conventional farming intensification, which has led to strong yield rise in last 20 years. Potatoes yields within the organic farming systems highly vary (50% to 125%). In year 2005 in the Czech Republic yields of bioproduction reached 62% - wheat, 63 % - rye, 75% triticale, 69% - oat and 62% - potatoes when compared to conventional production.

Costs

Organic farms reach 10-25 % lower total costs per one ha of agricultural land in comparison to comparable conventionally farming enterprises. This decrease is particularly evident when the variable costs are compared and make about 30-40 %. The fixed costs are almost higher by organic farms with accordance to farm type.

Organic farms reach lower material cost in comparison to conventionally farming companies. The most evident decrease (60-100 %) relates to pesticides and mineral fertilizers although there are also necessary allowed calcareous, phosphorus, potassium fertilizers to be used for organic farming.

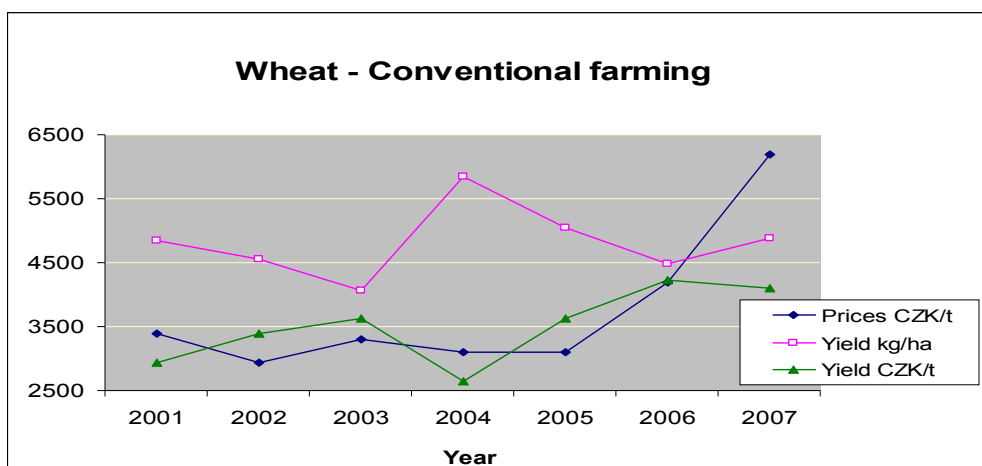


Figure 1 **Progress of yields, prices and cost for wheat production in conventional farming** (sources: Urban, Šarapatka a kol. 2005, ČSÚ, own research)

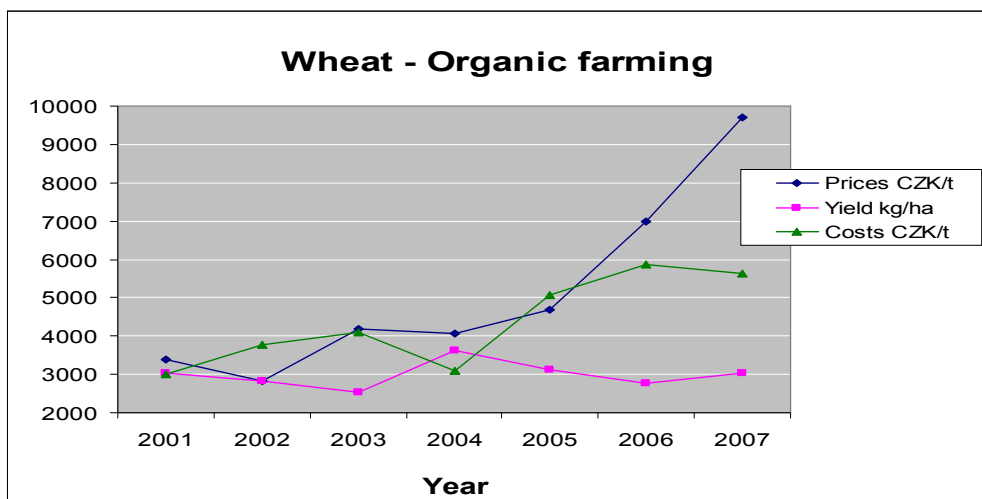


Figure 2 **Progress of yields, prices and cost for wheat production in organic farming** (sources: Urban, Šarapatka a kol. 2005, ČSÚ, own research)

Synthetic pesticides have to be replaced by allowed means as well. Seed grain costs in organic farming can be similar or higher. So far prices of seed grain have been lower due to no seed disinfection and own seed sources. After the law exception expiration these prices will be higher because of condition to use bio-seeds produced on organic farms only. Reproduction of bio-seed is more difficult and expensive, bio-preparates used for seed disinfection instead of synthetic disinfectants make the price higher as well.

Labour cost in organic farming on arable land are in most cases higher. In organic farming, instead of repeated herbicides application and divided nitrogen fertilizing carried out in conventional farming systems, mechanical or other non-

chemical weeding operation and manuring have to be applied several times. Harvest and postharvest costs do not differ much. Eventual differences can be caused using manual potatoes harvest or postharvest treatment, etc.

The need of labour intensively rises during the first year of conversion, still slightly increased during the second year and stabilize afterwards at a level 10 – 20 % higher compared to conditions before starting the conversion to organic farming principles. The need of labour before and after conversion decreases with dependence on a farm size rise. This can be contributed to the effect of concentration and focus on commercial crops that do not require any important labour rise. Highest growth of labour need is typical for vegetable production (up to 80%) and potatoes production (30%) which is caused by the need of mechanical weed and pests control. The conversion to organic farming principles is not necessary connected with higher labour requirements, for example change from milk cows raise to non-milk beef-raising or reduction high-demanding crops can bring even lower labour need finally.

The technological costs per area unit (ha) are always lower within organic farming. In year 2005 the technological costs were reduced by as follows: wheat 14%, rye 25%, tritikale 29%, oat 18% and potatoes 10% compared to conventional production. However due to lower yields organic farming cost per a production unit are always higher. In year 2005 organic farms recorded cost rise per one t of production as follows: wheat - 39%, rye - 26%, oat - 20% and potatoes - 45%. Triticale did not show any marked difference.

Buying prices of bioproduction and conventional production

In western Europe buying prices of vegetable bioproducts are 40% higher for cereal crops, 60% and more for potatoes and 200% for vegetable. These prices have been slightly falling down thanks to consumers voice, supermarket chains mostly and competitors from new EU member countries or third countries. On contrary to this prices of bioproducts have risen in recent years whereas these were until recently on very low levels compared to prices in Europe. Until recently common difference between price of bioproducts and conventional products (10-15 %) has risen and remained even after significant price rise up to European prices of conventional production in recent times. In the Czech Republic and in abroad the demand for bioproducts has exceeded the offer, conditions for export are very good. The problem consists in insufficient processing capacities which leads to raw material export, while the volume of imported bioproducts have dramatically risen. Analyses carried out in year 2005 shown highest difference between buying prices of organically produced and conventionally produced rye (87 %), lower for wheat 52 % and potatoes 57%, tritikale 21% and oat 12% only. Higher price compensates for lower yields of potatoes, wheat and rye achieved within organic farming. Because of low prices farmers lost their interest in oat, rye and tritikale. Resulting lack of domestic commodities led to buying abroad which contributed to more realistic valuation of conventional and organic production.

Based on information in Table 2. it is evident that lower production of organic farming is compensated by lower costs and higher prices. Marginal contribution as a difference between buying price and variable costs shows definite profitability of organic farming production. This does not apply to oat only.

Simultaneously these values show that this contribution cannot cover fixed costs. Price rise in years 2006 and 2007 has contributed to plant production rentability rise. As the variability of year is high, relation between yields in conventional and organic farming systems are relatively stable, both depend on input prices. Prices are the main factor affecting current variability of the marginal contribution and consequently the efficiency of particular crop cultivation. With continuing market opening (Czech Republic and EU market) this trend will remain.

Final effect of organic farming production is intensified by subventions. In year 2005 subventions to conventional farming (SAPS + TOP-UP + Organic Farming) made 4426 CZK/ha for arable land. The same subventions for organic farming (SAPS + TOP-UP + Organic Farming) reached 7946 CZK/ha. Thus organic farmers received 125 % higher subventions compared to conventional farmers. Taking into account that organic farming on arable land is in the phase of converting to organic farming very difficult in many aspects these subventions are rightful. In fact the contribution is payment for landscape tending and a margin in case the yields during the conversion phase dropped excessively. Stabilization or decrease of price variability at least can help to form supplier-customer relations. This is particularly important for minor plants and specialised technologies - which organic farming definitely belong to. It is important to create products vertical line and to connect producers, processors, breeding subjects, seed suppliers, consultant service etc. and finally to work out a suitable marketing strategy.

Table 2

Comparison of selected crops production efficiency within conventional and organic farming systems in year 2005

	Wheat		Rye		Triticale		Oat		Potatoes	
Farming system	Org.	Conv.	Org.	Conv.	Org.	Conv.	Org.	Conv.	Org.	Conv.
Yield [t*ha ⁻¹]	3,13	5,05	2,63	4,19	2,96	3,94	2,01	2,92	17,39	28,05
Technological costs [CZK*ha ⁻¹]	15865	18351	12561	15860	13140	17457	12656	15471	72215	80112
Technological costs [CZK*t ⁻¹]	5069	3634	4776	3785	4439	4431	6297	5298	4153	2856
Variable costs [CZK*ha ⁻¹]	10652	14812	8581	13088	9527	11520	9280	11570	44174	53997
Variable costs [CZK*t ⁻¹]	3403	2933	3263	3124	3219	2924	4617	3962	2540	1925
Buying price [CZK*t ⁻¹]	4700	3100	5600	3000	3500	2900	2500	2230	4778	3050
Market production [CZK*ha ⁻¹]	14711	15655	14780	12570	10360	11426	5025	6512	83089	85553
Marginal contribution [CZK*t ⁻¹]	1297	167	2337	-124	281	-24	-2117	-1732	2238	1125
Subventions [CZK*ha ⁻¹]	7946	4426	7946	4426	7946	4426	7946	4426	7946	4426
Subventions [CZK*t ⁻¹]	2539	876	3021	1056	2685	1123	3953	1516	457	158

* Technological cost = variable costs + mechanisation fixed costs

* Cost calculation according to Kavko 2006 (for standard technologies used in conventional farming systems according to Kavko 2006 and common technologies used in organic farming)

CONCLUSIONS

In conclusion can be stated that at present there are good conditions for organic farming on arable land in relation to prices, costs and state subventions, even though the efficiency of conventional production rises due to prices rise. Within organic farming the technological costs per area unit (ha) are lower, however due to lower yields the costs per production unit are higher. It is evident that lower production reached within organic farming systems is compensated by lower costs and higher buying prices, whereas the marginal contribution to organic farming makes the difference between buying price and variable costs and shows the profitability of organic farming production. In the Czech Republic the major limiting factors of organic farming are processing capacities. However operation programmes offer many opportunities how to these capacities provide, which should allow an effective utilization of production potential in areas with limited farming ways, cover domestic bioproducts demand, preserve farms prosperity and provide sufficient natural sources preservation.

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