The Economic Feasibility of Conventional and Organic Farm Production in Slovenia

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Summary

The aim of the research was the comparison of economic feasibility of most common conventional and organic farm production in Slovenia. The methodology of an integrated deterministic technologic-economic simulation system KARSIM 1.0 (DSM) application for cost analysis and decision-making support on farms is described in this article. The direct simulation model result is an individual conventional or organic farm product enterprise budget. The DSM consists of 148 deterministic production simulation models that enable different types of costs and financial feasibility calculations for conventional and organic production and food processing. The developed simulation model enables economical evaluation of some most important economic parameters (breakeven price, breakeven yield, financial result, total revenue and coefficient of economics). In conventional farming system the most suitable farm product is potato (Ke = 1.52), followed by milk and maize production (Ke = 1.10), wheat production (Ke = 1.06) and suckling cows production (Ke = 1.02). The husked spelt production is in conventional farming system economically infeasible (Ke = 0.82). In organic farming system the most feasible farm product is husked spelt (Ke = 1.56), followed by potato (Ke = 1.15), milk (Ke = 1.04) and suckling cows production (Ke = 1.03). Maize (Ke = 0.90) and wheat production (Ke = 0.83) are economically infeasible.

Key words

simulation models, KARSIM 1.0, economic efficiency, farm production planning, conventional and organic farming

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Introduction

In Slovenia, there are more than 86,300 farmers. Compared with the majority of European countries, farms in Slovenia are extremely small. The size of the average Slovene farms was very close to the size of the average Central European farm only in 1931, and today, with an average of 5.6 ha of farm land in use per household, it is some five times smaller than similar farms in the European Union (http://www.zrc-sazu.si/zgds/glasgow/20.pdf). Since the beginning of the 1990s, organic farming has rapidly developed in almost all European countries. More than 5.4 million hectares were managed organically by almost 143,000 farms in the 25 countries of the European Union. This constituted 3.3 % of the agricultural area and 3.2 % of the farms in the EU (FiBL, 2005). Organic farming is becoming more and more popular also among Slovene farmers. By the end of 2005 the number of farms practicing exclusively organic farming or taking up organic farming system amounted to more than 1,600 (or 1.85 % of all farms in Slovenia). The recent analysis showed that the average size of an organic farm is 13.4 ha. The statistical data shows that 4.7 % of arable land in Slovenia is controlled by organic inspection body (MKGP, 2006).

Producers - farmers, lending institutions and agricultural advisors need timely economic information in order to evaluate business opportunities and make sound business decisions. In addition, producers – farmers need guidance in establishing good business practices to enhance the profitability of their operations. The conversion from a conventionally managed farm to organic farming should not only improve the farm ecosystem but also assure the economic survival of the farm (Janke, 2000). The comparison of economic feasibility between organic and conventional farming has been modestly investigated in the literature. Direct economic comparison between organic and conventional farming with the use of farm accounting data of voluntarily book keeping farms has been conducted by Schneeberger et al. (2001). The economics of some most frequent organic farm products have been closely studied by Lampkin and Measures (1999). The implications of a full conversion to organic farming system in grassland region were analyzed by Freyer et al. (2005), where a full conversion to organic farming shows significant benefits not only for the environment but also from an economic point of view. Sartori et al. (2005) examines the efficiency of agricultural production systems and particularly the efficiency of energy use in a 3-year soya bean, maize and wheat rotation. This study also analyzed the production cost and the role of EU subsidies on farm strategies. Stalenga et al. (2006) evaluated the structure, agricultural production and economic efficiency of organic in comparison with conventional farms. Since real farm data required for cost calculations for financial planning of farm production is rarely available, this problem can be solved with the use of published enterprise budgets or gross margin calculations (Lampkin and Measures, 1999). Enterprise budget is a very useful for selecting the mix of enterprises which will be undertaken on the individual farm. They can be also used to provide an estimate of overall profitability and resource requirements (land, machinery and labor). Receipts and costs often are difficult to estimate in budget preparation because they are numerous and variable. At this point, the simulation based calculations could be applied (Csaki, 1985; Pavlovič, 1997; Rozman et al., 2002; Pažek, 2003; Pažek, 2006; Rozman et al., 2005; Pažek et al., 2006). The simulation based calculations (total costs enterprise budgets) enable quantification of additional costs (Kirner and Schneberger, 2000) and can be further used for economic evaluation of individual farm production scenario. Total costs enterprise budgets represent estimates of receipts (income), costs and profits associated with the production of agricultural products. Simulation models of agricultural systems have grown in popularity in recent decades due to their usefulness in tackling the inherent dynamic and/or stochastic nature of agricultural problems and due to increased computer capacity (Oriade and Dillon, 1997). Simulation may substitute for large-scale physical experimentation, which could otherwise take decades, especially in the case of perennial crops. Simulation provides the ideal tool for cost estimating since it provides a complete summary of production activity and allocating costs to products (Takakuwa, 1997). On the other hand the data availability can be a serious limitation in the planning process. Since real farm data required for cost calculations is rarely available, this problem can be solved with the use of published enterprise budgets, gross margin calculations (Lampkin and Measures, 1999) or by model calculations based upon technologic-economic simulations (Csaki, 1985; Pavlovič, 1997; Rozman et al., 2002; Pažek, 2003). In fact, many successful businesses intensively use simulation as an instrument for operational and strategic planning. In the last two decades, computer simulation has become an indispensable tool for understanding the dynamics of business systems (Kljajić et al., 2000). Experiences described in literature (Rozman et al., 2002; Hester and Cacho, 2003; Recio et al., 2003; De Toro and Hansson, 2003; Lisson et al., 2003, Romera et al., 2003, Rozman, 2004; Rozman et al., 2006; Pažek et al., 2006) emphasise that a variety of agricultural problems can be solved with computer modelling (simulation models).

In this paper the economic efficiency of some most common farm products in conventional and organic production systems in Slovenia are economically evaluated and compared. We present the methodology and application of simulation model KARSIM 1.0 for cost analysis of agricultural production.

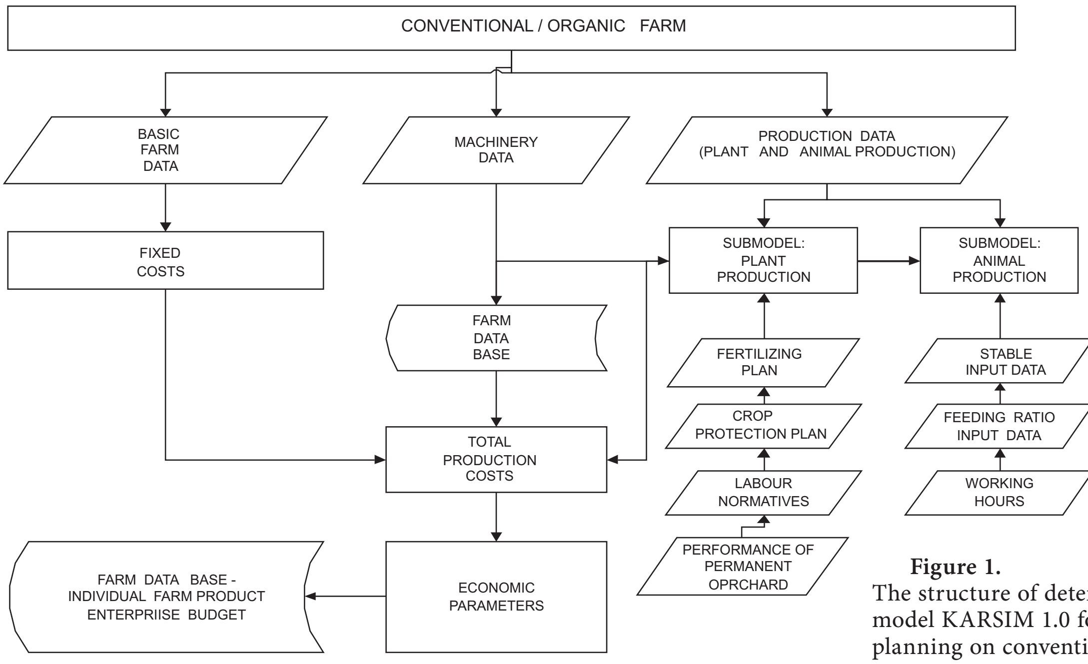

Figure 1.
The structure of deterministic simulation model KARSIM 1.0 for cost analysis and planning on conventional and organic farms

Methodology

For the economic analysis the static deterministic simulation model KARSIM 1.0 was developed. The model is based upon deterministic technologic-economic simulation (Csaki, 1985; Rozman et al., 2002), where the technical relations in the system are expressed with a set of equations or with functional relationships. The amounts of inputs used are calculated as a function of given production intensity, while production costs are calculated as products between the model's estimated inputs usage and their prices. The structure of the simulation model can be observed in Figure 1. The main result of the model is the "technological chart" with total costs enterprise budget. The model consists of 148 sub-models representing each conventional and organic crop and animal production (Figure 1).

The system as a whole represents a complex calculation system and each sub-model results in a specific enterprise budget. Through a special computer interface, the system enables simulation of different production possibilities / alternatives at a farm level. All iterations (calculations for individual farm product) are saved into a database that can finally be used as one of the data sources for detailed farm management analysis. The simulation system is built in

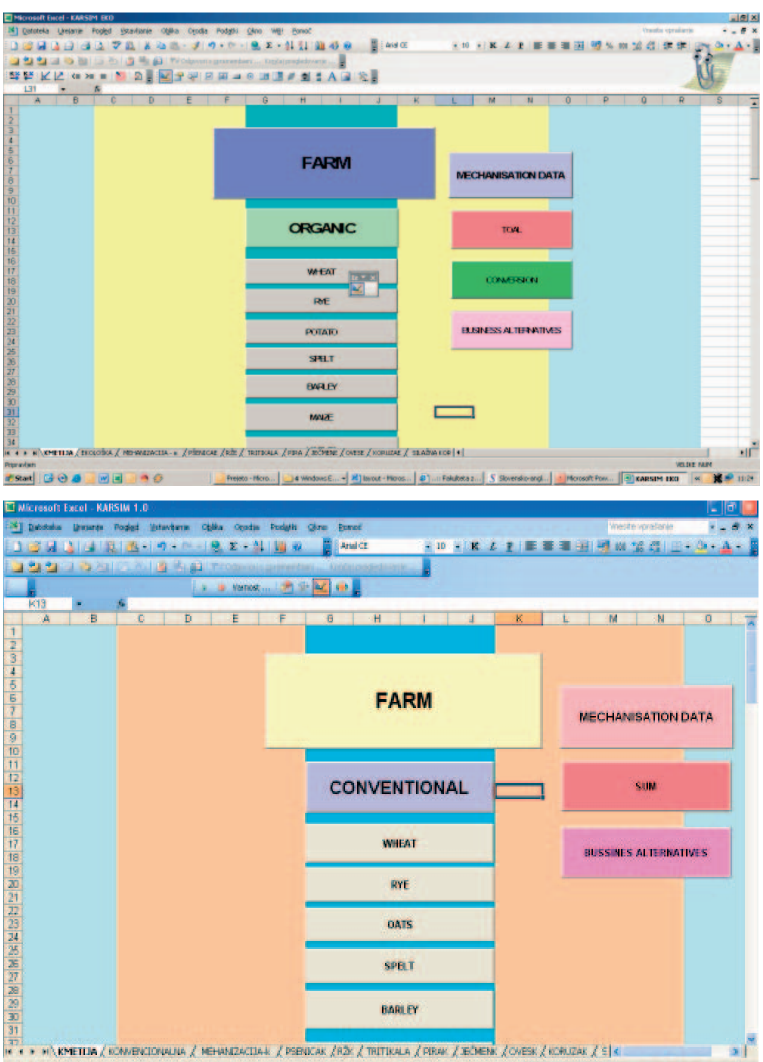

Figure 2.
The main menu of simulation model KARSIM 1.0

Table 1. Results of technologic – economic simulation model KARSIM 1.0 for conventional farm products

Conventional production	Production (kg,l/ha,herd)	Financial result (EUR/year)	Total revenue (EUR/year)	Selling price (EUR/kg,l)	Break even yield (kg,l)	Break even price (EUR/kg,l)	Coefficient of economics - Ke
Wheat	7,000	49.52	817.91	0.12	6,576	0.11	1.06
Spelt (husked)	1,764	- 151.78	684.58	0.39	2,155	1.47	0.82
Maize	9,315	135.20	1,477.09	0.16	8,462	0.14	1.10
Potato	35,200	1,528.72	4,480.05	0.13	23,575	0.08	1.52
Milk	37,625	901.36	9,734.39	0.26	34,141	0.22	1.10
Suckling cows	1,001	76.49	4,177.10	4.17	983	4.10	1.02

Table 2. Results of technologic – economic simulation model KARSIM 1.0 for organic farm products

Organic production	Production (kg,l/ha,herd)	Financial result (EUR/year)	Total revenue (EUR/year)	Selling price (EUR/kg,l)	Break even yield (kg,l)	Break even price (EUR/kg,l)	Coefficient of economics - Ke
Wheat	3,400	- 103.70	510.85	0.15	4,090	0.18	0.83
Spelt (husked)	1,470	284.85	797.45	0.54	945	0.35	1.56
Maize	4,455	- 112.46	966.70	0.22	4,973	0.24	0.90
Potato	17,600	397.70	2,985.48	0.17	15,503	0.15	1.15
Milk	30,000	408.73	10,015.02	0.33	28,775	0.31	1.04
Suckling cows	1,001	137.43	4,177.10	4.17	969	4.04	1.03

an Excel spreadsheet environment and upgraded with the Visual Basic code in order to ensure better functionality of a user friendly calculation system (Figure 2).

Results and discussion

The direct simulation model result is an individual conventional or organic farm product enterprise budget. The developed model was applied for calculation of some most important economical parameters for expressing economical feasibility of individual conventional (Table 1) and organic farm products (Table 2).

The applied methodology should bring unequivocal clarity to the decision which farm production or business alternative should be favoured and implemented on an conventional or organic farm under presumption of given input data (Table 1 and 2). All parameters are calculated for 1 ha field crops production and by livestock production (milk and suckling cows) for the herd (5 animals / herd). In conventional farming system the most suitable farm product is potato (Ke = 1.52), followed by milk and maize production (Ke = 1.10), wheat production (Ke = 1.06) and suckling cows production (Ke = 1.02). The conventional spelt production is not economically feasible (Ke = 0.82) . The last can be contributed to lower yield of conventionally produced spelt.

The Table 2 presents the simulation results of KARSIM 1.0 for organic farm production. As shown in the Table 2 the most feasible farm product is husked spelt, which results with the highest coefficient of economics (Ke = 1.56). Compared to conventional spelt production, the selling price in organic farming system is 39.8 % higher and the financial result in this case is positive value (284.85 EUR). The second most suitable farm production is (under presumption of given input data) the production of potato (Ke = 1.15), followed by milk (Ke = 1.04) and suckling cows production (Ke = 1.03). The economic evaluation of conventional (Table 1) and organic suckling cows production (Table 2) shows the minimum differences between both farming systems (Ke = 1.02 and Ke = 1.03). The results could be explained by the same selling price of the cattle despite significant differences between both production systems (feeding ratio, animal welfare). The organic maize (Ke = 0.90) and wheat production (Ke = 0.83) are economically inefficient.

It has to be mentioned here that the research focused on comparison between production systems (therefore the farm fixed costs were not really relevant) and that successful marketing of products was assumed.

Conclusions

The farm production enterprise budgets were used in the first stage of a research in order to conduct financial and technological analyses of each analyzed farm product. The results of enterprise budgets were used for the analysis and decision making which business production/alternative is the most suitable considering economical parameters. In conventional farming system the most feasible product is potato, followed by milk, maize and suckling cows production. The conventional spelt production is economically not feasible. The most feasible organic farm product is husked spelt with the highest coefficient of economics, followed by potato, organic milk and suckling cows. Organic maize and wheat production is economically not feasible.

The application of technologic-economic simulation models for preparation of enterprise budgets represents a powerful analysis support tool which enables feasibility analysis at different model input parameters. We believe that application of the proposed simulation tool would increase the accuracy of information needed for developing whole farm business plans.

The presented methodological framework (DSM) for cost analysis and decision support on conventional and organic farms could provide additional information support, bring additional clarity to the decision, and could therefore play an important role in further development of organic farming systems.

References

Csaki C. (1985). Simulation and system analysis in agriculture. Elsevier, Amsterdam

Cunder T. Characteristics of Agriculture in Slovenia (http://www.zrc-sazu.si/zgds/glasgow/20.pdf)

De Toro A., Hansson P. A. (2003). Analysis of field machinery performance based on daily soil workability status using discrete event simulation or on average workday probability. Agricultural Systems 79: 109-129

FiBL - Forschungsinstitut für biologischen Landbau (http://www.organic-europe.net/europe_eu/statistics.asp)

Freyer B., Darnhofer I., Eder M., Lindenthal T., Muhar A. (2005). Total Conversion to Organic Farming of a Grassland and a Cropping Region in Austria – Economic, Environmental and sociological Aspects. 15th IFOAM Organic World Congress, 21.-23. September, pp 308-312

Hester M. S., Cacho O. (2003). Modelling apple orchard systems. Agricultural Systems 77: 137-154

Janke R. (2000). Whole-Farm Planning for Economic and Environmental Sustainability, Kansas State University (http://www.oznet.ksu.edu)

Kirner L., Schneberger W. (2000). Mehrkosten der Biomilchproduktion in Österreich. Berichte über landwirtschaft 80/2: 247-261

Klajić M., Bernik I., Škraba. A. (2000). Simulation Approach to Decision assessment in Enterprises. Simulation 75/4: 199-210

Lampkin N., Measures M. (1999). Organic farm management handbook – 3rd Edition University of Wales, Aberystwyth, Elm farm research centre

Lisson S. N., Brennan L. E., Bristow K. L., Keating B. A, Hughes D. A. (2003). DAM EA$Y- Software for assessing the costs and benefits of on farm water storage based production systems. Agricultural Systems 76: 19-38

MKGP (2006). ANEK – Akcijski načrt razvoja ekološkega kmetijstva v Sloveniji do leta 2015. Ljubljana

Oriade C. A., Dillon C. R. (1997). Developments in biophysical and bioeconomic simulation of agricultural systems: a review. Agricultural Economics 17: 45-48

Pavlovič M. (1997). Systemanalyse Internationaler Hopfenwirtschaft - Entwicklung des Simulationsmodells für technologisch-ökonomische Analyse auf Hopfenanbaugebieten in Slowenien, Verlag dr. Kovač, Hamburg

Pažek K., Rozman Č., Borec A., Turk J., Majkovič D., Bavec, M., Bavec, F. (2006). The Use of multi criteria models for decision support on organic farms. Biol. agric. hortic. 24/1: 73-89

Pažek K. (2003). Finančna analiza ocenjevanja investicij dopolnilnih dejavnosti na ekoloških kmetijah / The financial analysis (CBA) of supplementary activities on organic farms, Master Thesis, University of Maribor, Faculty of Agriculture, 168

Recio B., Rubio F., Criado J. A. (2003). A decision support system for farm planning using Agrisupport II. Decision Support Systems 36: 189-203

Romera A. J., Moriss S. T., Hodgson J., Stirling W. D., Woodward S. J. R. (2003). A model for simulating rule-based management of cow-calf system. Computers and Electronics in Agriculture 42: 67-86

Rozman Č. (2004). Aplikacija simulacijskih modelov in pozitivnega matematičnega programiranja pri ekonomski analizi sadjarske proizvodnje / Application of simulation models and positive mathematical programming for the economic analysis of fruit production. Ph. D. Thesis, University of Maribor, Faculty of Agriculture, 151

Rozman Č., Tojnko S., Turk J., Par V., Pavlovič M. (2002). Die Anwendung eines Computersimulationsmodells zur Optimierung der Erweiterung einer Apfelplantage unter den Bedingungen der Republik Slowenien. Berichte über Landwirtschaft 80/4: 632:642

Sartori L., Basso B., Bertocco M., Oliviero G. (2005). Energy Use and Economic Evaluation of a Three Year Crop Rotation for Conservation and Organic Farming in NE Italy. Biosystems Engineering 91/2: 245-256

Schneeberger W., Eder M., Lacovara L., Garcia-Rosell J. C. (2001). Buchführungsergebnisse von biologisch und konventionell wirtschaftenden Futterbau und Marktfruchtbetrieben in Österreich. Bodenkultur 52/4: 329-341

Stalenga J., Kus J., Kopinski J. (2006). Evaluation of the organisation and economic efficiency of organic and conventional farms in the Kujawsko-Pomorskie voivodship. Joint Organic Congress, Odense, Denmark, May 30-31 (http://orgprints.org/8221/01/Stalenga_Kus_Kopinski_2_pages.doc)

Takakuwa S. (1997). The Use of simulation in Activity-Based Costing for Flexible Manufacturing Systems. Proceedings of the 1997 Winter Simulation Conference, pp 793-800

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