Influence of Different Technologies on the Competitiveness of Strawberry Production in Croatia

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Summary

In this paper, two production technologies are compared for the production of strawberries: the two-year technology used in Croatia and the one-year technology used in Germany. The goal of this comparison is to determine the influence of different technologies on competitiveness of production. Research was conducted in agricultural businesses in both Croatia and Germany.

A policy analysis matrix (PAM) was created and coefficients calculated using the domestic resource cost (DRC) method.

Results showed that production of strawberries in Croatia, with the use of the two year production technology (technology A) is at the very boundary of competitiveness (DRC=1.01). However, if this technology is replaced with the one-year production technology used in Germany (technology B), production becomes more competitive (DRC=0.64). The DRC coefficient shows that the production of strawberries using technology B has comparative advantages over technology A, and that altering the technology of strawberry production in Croatia would increase the competitiveness of strawberry production in family run farms.

Key words

different technologies, competitiveness, Croatia, strawberry production, DRC coefficient

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Introduction

The total annual strawberry production in the whole world amounts to 2 million tons, half of which being grown in Europe (exclusive of former Soviet Union). North and Middle America are in the second place with approximately 28%, and in the third place there is Japan with the share of 10% in the total world production. South America, Africa, Australia and New Zealand participate in the total strawberry production with the share of only 1.3% (Naumann, Seipp 1989).

Exact quantities of strawberries being grown in Croatia are hard to estimate since the part of production comes from family run farms, and due to disproportion between the official statistical data and the field data. However, it is indisputable that the strawberries make two-third of berry fruit production on domestic market with trend of further increase. This is undoubtedly the most demanded berry fruit, which is supported by significant increase of strawberry growing areas in the last 10 years.

Though, based on increase of strawberry growing areas, a promising future for the producers could be discussed, market liberalization and foreign competition are something to be concerned about (Ministry of Agriculture, Forestry and Water Management, 2001). The purpose of this paper is to indicate the problem concerning competitiveness of strawberry production in Croatia, to determine if the competitiveness exists and to what extent, to show to what extent application of different technologies influences strawberry production competitiveness, as well as to present particular solutions and results which would, at the end, ensure more profitable strawberry production.

The research sample were five chosen family run farms in Germany (Baden-Württenberg) and five family run farms in continental Croatia where the strawberry cultivar Elsanta has been grown.

To achieve this goal of the research it was necessary to comprise detailed research of technological and economic problem areas from the practice, at the same time taking into account differences of agricultural production in Germany and Croatia.

In the paper, two different growing technologies are compared: two-year technology which is represented in Croatia and one-year technology which is represented in Germany.

Material and methods

Besides policy analysis matrix and sensitivity analysis, the domestic resource method (DRC), which is used for examining production competitiveness, was applied.

The DRC method examines international competitiveness by comparing costs of domestic resources used in the production of a particular product (Landell Mills Limited in association with DEVCO, 2001). In the DRC method, economic or world prices for input and output valorization are used, since actual prices (domestic, real) do not give an objective presentation of the current status because they may show a high level of protection, i.e. domestic support which acts in the market same as monopolistic prices in the input or final products market (Monke, Pearson, 1989).

The DRC method is presented as a ratio of domestic costs to the real value added. Though the DRC method is one of the best methods for measuring comparative advantages, it contains some particular credible requirements, such as data actuality and technological exactness and uniformity in defining production conditions of comparative technologies.

In this respect, our statistics do not follow the technological normative or often follow the ones incomparable by scope. Therefore, the poll survey was used in the framework of the case study. In the poll survey, 5 family run farms in Croatia as well as 5 in Germany were examined.

Taking into account that the DRC method is static, the result obtained by DRC method would show if the sector or the production system (in our case the application of different technologies in strawberry production) has comparative advantages as compared to international production (Pearson, Gotsch, 2002). The results would not indicate the reason or the source of comparative advantages or disadvantages. Guidance in this respect may be the policy analysis matrix, which indicates differences between real (actual) and economic prices. Policy analysis matrix is a product of two accounting identities, one defining profitability as the difference between revenues and costs and the other measuring the effects of divergences as the difference between observed parameters and parameters that would exist if the divergences were removed. Profits are defined as the difference between total sales revenues and costs of production. Policy analysis contains two cost columns, one for material inputs and the other for domestic factors. The process of disaggregation defines them for each input in production. In the policy analysis matrix profitability is measured horizontally. Profits are found by subtraction of costs from revenues.

Publications of Central Bureau of Statistics (Statistički ljetopis), information and data from technical, statistical and other publications, data of Croatian Chamber of Economy, as well as reports of international organization (FAO) were used.

The data used for Germany were: the data of State Office of Statistics (Bundesanstalt für Statistik) and Marketing Information System (Zentrale Markt- und Preisberichtstelle, 2000) with headquarters in Bonn.

As two different technologies are compared in this paper, two-year technology (technology A) and one-year (technology B), to get comparable data they have been brought to one year. All revenues, costs and profits are expressed per hectare per year. Actual revenues and costs prices are the result of the poll survey and the direct observation of appropriate system (in this case strawberry production) in the framework of agricultural policy.

To compare the advantage and efficiency of technology A and technology B following coefficients are calculated: DRC or domestic resource cost coefficient, NPC or nominal protection coefficient, and EPC or effective protection coefficient.

If the DRC coefficient is greater than one (DRC>1) monitored production is not competitive because actual costs are higher than value added. The DRC coefficient less than one (DRC<1) indicates competitive production.

As social prices are a result of actual value estimation, sensitivity analysis of effects of changes in economic prices is the key element in the presentation of analysis matrix results.

Among three elements defining the DRC coefficient, namely total profits, material inputs and domestic resources indicated in economic prices, the first one contains two very variable parameters. These are strawberry yield and price calculated per unit. Sensitivity analysis was carried out in order to examine the effects of change of these two parameters. In the first place, yield was varied in a range from 5 to 10% increase per hectare, i.e. with 10% and 20% decrease per hectare at constant price.

Strawberry production technology in Germany (technology B) used in this research is based on one-year, one-row growing of strawberries that are obtained from fresh green plants on the plastic mulch.

The surveys were conducted on five family run farms in Baden-Württenberg region, i.e. Ortenau, well-known strawberry growing area.

According to the data obtained by poll survey, average number of plants per hectare amounts to 27,360, space between rows is 1 m, and space in the row is 0.4 m.

Despite the trend of early strawberry varieties, more than 90% percent of strawberry growing area in Germany represents mid-early strawberry cultivar Elsanta. This was one of the reasons to discuss cv Elsanta in the paper, i.e. the researches were conducted on the family run farms growing this particular strawberry cultivar.

Farms that were examined used seasonal workers. Average use of working hours amounts to 1,598.4, out of which number 204.4 hours were of producer's labor, and 1,394 hours were of hired labor. Strawberry truck is used for picking up. Average result of the worker with the truck amounts to 15 kg of strawberries per hour.

Average yield per plant is 0.75 kg, and average yield per hectare is 21,368 kg.

Strawberry production technology in Croatia (technology A) used in this research is based on two-year, two-row growing of strawberries that are obtained from fresh green plants on the plastic mulch.

The surveys were conducted on five farms in Zagreb County for the strawberry cultivar Elsanta. In the area of Zagreb County, i.e. at family run farms that were examined, climate and soil conditions correspond with the same conditions in Ortenau area, Germany.

Average quantity of plants per hectare amounts to 37,000. Space between the plastic mulch is 1.2 m, while on the plastic mulch there are two rows with space between plants 25 cm x 25 cm. Strawberries are planted manually, in the beginning of August, and the strawberry production lasts two years.

Strawberry harvest is carried out manually, without the truck. The picking on the researched farms was carried out by using producer's and seasonal work. Average use of working hours amounted to 2,155, out of which number 470 hours were of producer's labor, and 1,685 hours were of hired labor. Average result of worker amounts to 10 kg strawberry per hour.

Average yield per plant was 0.46 kg, and average yield per hectare was 15,900 kg.

Results and discussion

The strawberry production with the use of both analysed technologies has actual profit higher than zero (Table 1 and Table 2). Profit is significantly higher (48,873.32 kn compared to 12,658.67 kn) with the application of technology B.

Figures from the Table 1. show that strawberry production with the use of technology A achieves profit valorized at actual prices. However, at economic prices profit is negative, which means that strawberry production with the use of technology A can not, from economic point of view, exist without the support of the state. On the other hand, allocation of state financial resources in nonprofit activities would represent absolute failure of agricultural policy.

The DRC coefficient obtained by the DRC method shows that strawberry production with the application

Table 1. Analysis matrix – Technology A (kn)

	Total revenues	Material inputs	Domestic resources	Profit
Actual prices	147,075.00	75,712.20	58,704.13	12,658.67
Economic prices	129,426.00	71,324.05	58,512.78	-410.83
Transfers	17,649.00	4,388.15	191.35	13069.50

Table 2. Analysis matrix – Technology B (kn)

	Total revenues	Material inputs	Domestic resources	Profit
Actual prices	197,654.00	88,523.39	60,257.29	48,873.32
Economic prices	173,927.60	80,347.34	59,888.89	33,691.37
Transfers	23,726.40	8,176.05	368.40	15,181.95

Table 3. Coefficients

	DRC	NPC	EPC
Technology A	1.01	1.14	1.23
Technology B	0.64	1.14	1.17

Table 4.
Sensitivity analysis in relation to the DRC coefficient – yield changes

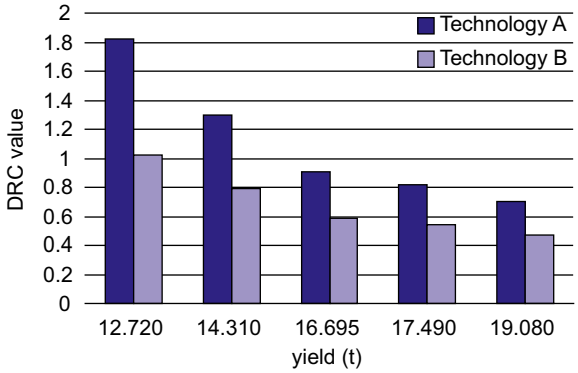
% strawberry yield change	The DRC coefficient	
	Technology A	Technology B
> 20%	0.70	0.47
> 10%	0.82	0.54
> 5%	0.91	0.59
< 10%	1.30	0.79
< 20%	1.82	1.02

of technology A is at the boundary of the competitiveness (Table 3.). The coefficient is 1.01.

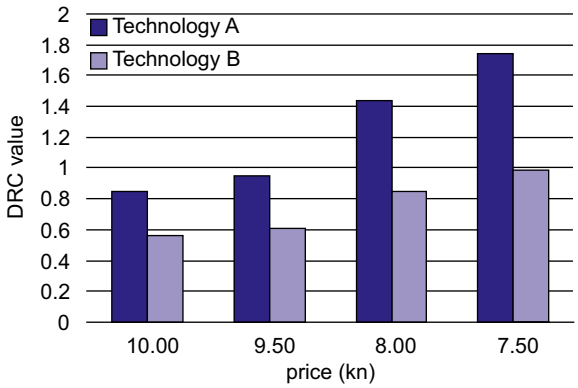
By applying technology B, strawberry production becomes significantly more competitive, because the calculated DRC coefficient is 0.64 (Table 3.).

The analysis was carried out with respect to both technologies, A and B. The results of analysis are shown in the Table 4, Graph 1 and Graph 2.

The basic goal of this paper was to determine and analyze the influence of different technologies on competitiveness in strawberry production in family run farms. Preliminary assumption was that using another production technology would increase competitiveness of strawberry production in family run farms. Change of production technology would lead to better production and economic results and would be more competitive on international market.



Graph 1.
Sensitivity analysis in relation to the DRC coefficient – yield change



Graph 2.
Sensitivity analysis in relation to the DRC coefficient – price change

Changes in any of the stated segments could lead to changes in the final conclusions. Changes of economic prices may nevertheless be valorized by preliminary sensitivity analysis, which was done in this paper wherever possible regarding the possible effects of changes on the results. On the other hand, it is very difficult to take into account changes in technology in the calculations because their speed and the method are hardly foreseeable and measurable.

Since strawberry production is of seasonal character, fruit maturing period and period for reaching the market are of the utmost importance for realization of good financial results. When growing strawberries in the field (technology A) the method for fostering of maturing is not used in Croatia, so that cv Elsanta is on the market earliest in the last week of May. At the same time, German producers that place it on the market already in mid May realize much better financial results,

what is the consequence of earlier maturing caused by covering strawberries with acryl foils.

One-row growing of strawberries (technology B), contrary to the two-row (technology A), does not create same microclimate on the plant level due to the different space between the rows. This is, undoubtedly one of the most important reasons that makes average use of plant protection substances lower when technology B is used (average 16 kg per ha) than the average use of plant protection substances when technology A is used (22 kg per ha).

Other important reason could be qualifications of agricultural producers to determine adequate terms and quantity of treatment substances.

The analysis shows that the profit defined in the framework of the basic budget at economic prices, for technology A, is lower than the profit at real prices for the same technology. This was expected since real prices contain certain level of market protection and agricultural policy measures.

When, under Croatian market conditions, technology B is discussed, it can be noticed that profit is decreasing in the framework of the basic budget expressed in economic prices. Decrease is nevertheless much lower in comparison to technology A.

This means, that when stated technologies are brought to the same economic denominator (world or economic prices), technology B ensures higher profit in strawberry production.

As the result, the DRC coefficient used to measure competitiveness within the DRC method indicates comparative advantages of strawberry production in Croatia. With the use of technology A it is 1.01 meaning that strawberry production is at the very boundary of competitiveness. It has to be emphasized that strawberry production in Croatia is not subsidized from the state budget, i.e. the measures of agricultural support in any form (direct or indirect) are not related to this production. The production is completely subject to the market. The fact that strawberry production is at the very boundary of competitiveness means there is no need for significant support in order to achieve competitiveness with the application of technology A.

On the other hand, the application of technology B in strawberry production gives positive results indicated as well in the DRC coefficient. In this case, it is 0.64 and implies competitive production which, concerning comparative advantages, has real export possibilities. If the nominal protection coefficient (NPC), which is 1.14, is taken into account, it is obvious that customs protection in this sector is not so huge, so further decrease thereof will not have crucial influence on production competitiveness.

Conclusions

Based on the goal to analyze and compare different strawberry production technologies and to determine their influence on competitiveness of strawberry production, and based on conducted research, the following conclusions have been made.

Strawberry production in Croatia, with the application of the two-year growing technology is at the very boundary of competitiveness. Competitiveness is measured by the DRC coefficient, which, if greater than 1 indicates uncompetitive production, and if less than 1 indicates competitive production. In this case the DRC coefficient is 1.01.

If the one-year production technology, common in Germany, is applied in Croatian strawberry production, the production becomes very competitive. In this case, the DRC coefficient is 0.64. It indicates that strawberry production with the application of technology B has comparative advantages in relation to the application of technology A.

Despite of decreases in relation to actual prices, the profit expressed in economic prices for the both technologies is positive. If the profit at economic prices was negative, it would mean that the production could not exist without the support of the state which is not the case here.

State investment in the case of negative profit indicated in economic prices would be a loss, because in that case actual costs would be higher than the value added.

The NPC or the nominal protection coefficient is 1.14 and presents customs protection, which is not high in this case. If the subject of observation is technology B with the DRC coefficient of 0.64 and with mentioned NPC of 1.14 conclusion can be made that in the next period, characterized by further liberalization of agricultural and foodstuffs products, i.e. by lowering the customs taxes, there is still sufficient space to remain competitive in strawberry production in international proportions, by the application of technology B.

Based on sensitivity analysis, the possibility of almost 20% yield decrease with the application of technology B has been determined, with the possibility that the production remains competitive. At the same time, at least 5% yield increase is necessary (with minimal or no additional inputs) in order to make strawberry production competitive, with the application of technology A.

References

Landell Mills Limited in association with DEVCO (2001). The fruit sector competitiveness report

Ministarstvo poljoprivrede i šumarstva (2001). Strategija razvitka Republike Hrvatske – Prehrana

Monke, E., Pearson, S. (1989). The Policy Analysis Matrix for Agricultural Development, Cornell University Press

Naumann/Seipp (1989.). Erdbeeren, Eugen Ulmer GmbH & Co., Stuttgart

Pearson S., Gotsch, C., (2002). The Basic Policy Analysis Matrix Manual For Regional Workshops

ZMP (2000). Osteuropa Agrarmarkte – aktuell, Bonn

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