ECONOMIC AND AGRONOMIC ANALYSIS OF CONVENTIONAL AND ORGANIC CONCEPT OF CUCUMBER GROWING

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Summary

Contemporary agro-technology enables high and stabile yield of slicing cucumber throughout the whole year. This study deals with total costs of production, yield per surface unit and the main parameters of profitability of producing slicing cucumber in the greenhouses and in the open field in conventional and organic farming system. Growing cucumbers in the greenhouses and in accordance with the principles of organic farming are the main conditions for higher prices in the market. The highest total costs (820.00 EUR/are) but also the highest gain (225.00 EUR/are) was realized in producing slicing cucumber both in the greenhouse in the organic farming system. Financial losses were recorded when growing cucumbers in the open field despite lower costs, both in organic and conventional system of growing: 29.00 EUR/are, i.e. -15.00 EUR/are, respectively. The business rate of profitability and the coefficient of cost-effectiveness were higher in growing cucumber in greenhouses in both concepts of production.

Key words: *cucumber, profit, business rate of profitability, greenhouse, organic production.*

JEL: *Q16*

Introduction

Cucumber (*Cucumis sativus* L.) in Serbia is cultivated in the open field and in greenhouse, at the surface of 8,800 ha, with average yield 6,271.20 kg/ha (FAO, 2012). There are genotypes that are suitable for proceeding and pickling and genotypes for fresh consumption, so-called slicing cucumber (Staub et al., 2008). Pickling cucumbers in Serbia are mostly grown in the

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open field, while slicing cucumbers are usually grown in house gardens or in greenhouses.

The cucumber is originally from Southern Asia, but now grows on most continents thanks to the new growing technologies. Nowadays it can be grown even in agro-ecological conditions that are not suitable for normal growth and development of this species (Pavlović et al., 2002). Contemporary agro-technical measures enable high yield of slicing cucumber in greenhouses. In temperate climate, in conditions without artificial light it is possible to achieve yields of up to 2,000.00 kg/are (Mao et al., 2003; Mohammadi and Omid, 2010). In organic slicing cucumber production in greenhouse and in Mediterranean climate, yields were up to 1,784.00 kg/are (Tuzel et al., 2007).

In Serbian agro-ecological conditions, slicing cucumber is grown from the nursery or from the direct sowing. Producers can plan time of maturity and in this way produce the most profitably. Direct sowing is performed at the end of April and at the beginning of May when also seedling is planted in the open field. Seedling can be produced during winter months in greenhouses with additional heating. Seed in greenhouses without additional heating can be sown at the beginning of April, while the yield can start in approximately 40 days (Damjanović et al., 2005). In this period the prices of the slicing cucumber are usually higher than at the end of June and the beginning of July, which is the period when cucumber yields in the open filed (STIPS, 2013).

In order to obtain higher prices in the market, the significant point could be the certificated organic production. Organic production implies ecological management of production, improvement of biodiversity, circulation of matter in the nature, microbiological activity in land and environment protection (Zdravković et al., 2010). Due to fears of harmful substances, pesticide residues and heavy metals in vegetables, many consumers are ready to pay from 30 to 80% more for certified organic products. Due to higher prices of organic products, certified organic production is more profitable despite lower yield and higher costs of production (Engindeniz 2002; Adžić et al., 2010).

The aim of this study was to research the profitability of growing slicing cucumber in greenhouses without additional heating and in the open field in organic and conventional way since these are two actual concepts of growing vegetable.

Material and methods

In order to research the profitability of slicing cucumber production according to concept of conventional and organic crop production, the trial was set at the research field and in the greenhouse at the Institute for Vegetable Crops, Smederevska Palanka. Standard methods of cucumber growing (both concepts) were applied. Data regarding the prices of material were collected from certified organic producers from Stara Pazova and Belgrade. Data regarding the costs of production and yields from certified organic production were collected by interviewing method (Pavlović et al., 2010; Pavlović, 2014).

The cucumber was grown in greenhouses without additional heating both at the Institute for Vegetable Crops and at the interviewed producers. The cost of greenhouse construction and

plastic sheeting were calculated by dividing their rates with the predicted lifetime expressed in years (Table 1), (Pavlović, 2014).

Selling prices of slicing cucumber produced in conventional concept of growing were taken from the wholesale market. Sale price of fruits produced in the organic concept were collected by interviewing salesmen from Belgrade and Novi Sad that produce and sell the certified organic vegetable (Pavlović et al., 2010; STIPS, 2013).

Economic analysis was performed by applying method of analytical calculations (Bošnjak and Rodić, 2010) in order to establish the cost price and calculate the basic parameters of profitability of slicing cucumber production. The total cost (EUR), value of production (EUR/are), cost price (EUR/kg), financial results (EUR/are), border of profitability (kg/are), business rate of profitability (%) and coefficient of cost-effectiveness (e) were calculated.

Results and discussion

Production costs directly affect the profit and manufacturers tend to reduce them as much as possible. For successful production management, managers must always know the costs, as well as their structure and dynamics (Kay et al., 2008). The highest production costs (820.00 EUR/are) were in the organic cucumber production in greenhouses. The costs of conventional production in greenhouses were 529.00 EUR/are. The lowest costs were both in conventional and organic production in the open field 264.00 and 405.00 EUR/are. The total costs of greenhouse production are higher due to the purchase of a greenhouse. During production in greenhouses more human labour is required and specialized machinery costs are increased. Insight into individual costs and the share of these costs in the total production structure are important for decision making, because the economic analysis of production can recognize the dominant group costs, which largely affect the cost of the finished goods (Kanisek et al., 2008).

Cost structure (Table 1) shows that the highest individual cost in both ways of production is the supply of plant material. Quality seedling is a condition of safe and stable production. This cost can be further increased with the organic concept of growing of slicing cucumber, since it is necessary to provide certified organic nursery (Ugrenović et al., 2010). Significant share in the total costs is the protection of plants from pests and diseases. Cucumber is extremely sensitive to plant pathogens so this problem can only be overcome by growing varieties resistant to economically most significant pathogens in Serbia (Mijatović et al., 2001). This would significantly affect the increase the profitability through reducing costs.

During this study, the yield in the greenhouse was 1,450.00 kg/are in conventional system and 1,100.00 kg/are in organic, which is in accordance with some authors (Mao et al., 2003; Tuzel et al., 2007; Mohammadi and Omid, 2010).

Table 1. Total costs of conventional and organic slicing cucumber production in the open field per surface unit (EUR/are)

Costs	Conventional		Organic	
	Greenhouse	Open field	Greenhouse	Open field
	EUR/are	EUR/are	EUR/are	EUR/are
Mineral fertilizer	34.00	34.00	0.00	0.00
Manure	0.00	0.00	5.00	5.00
The removal of manure	0.00	0.00	15.00	5.00
Primary treatment	10.00	5.00	10.00	5.00
Seedling	150.00	80.00	200.00	100.00
Additional treatment	5.00	2.00	5.00	2.00
Preparation for planting	5.00	2.00	5.00	2.00
Greenhouse construction 1/10*	40.00	0.00	40.00	0.00
Plastic foil 1/2*	50.00	0.00	50.00	0.00
Support for the plants	20.00	0.00	20.00	0.00
Foliar fertilizer	5.00	5.00	0.00	0.00
Row crop cultivation	5.00	1.00	5.00	1.00
Irrigation	10.00	5.00	10.00	5.00
Irrigation system	80.00	40.00	80.00	40.00
Seasonal labour	25.00	15.00	35.00	20.00
Approved pesticides	90.00	75.00	140.00	120.00
Certification costs	0.00	0.00	200.00	100.00
Total costs	**529.00**	**264.00**	**820.00**	**405.00**

Source: According to personal research, Pavlović, 2014.
Note: *1/10 - time of depreciation is 10 years; *1/2 - time of depreciation is 2 years.

Yield in the open field was 940.00 kg/are in conventional and 780.00 kg/are in organic production. Due to climatic conditions and the need for the additional heating, the cucumber production in the open field starts later and the vegetation period and the period of fruiting are shorter, comparing to greenhouse production, which directly influences the total yield of the fruits (Lešić et al., 2004).

Prices of agricultural products are in connection with supply and demand (Babović et al., 2011; Knežević and Popović, 2011). Prices are higher during spring when plants from greenhouses fructify. During summer, when fruits from the open field are yielding, prices are much lower due to a higher supply (STIPS, 2013). Certified organic products, regardless to time of selling are more expensive because the demand is still higher than the supply (Table 2).

Table 2. Yield per area unit (kg/are), price per unit (EUR/kg), the value of production (EUR/are)

Indicators	Conventional		Organic	
	Greenhouse	Open field	Greenhouse	Open field
Yield (kg)	1,450.00	940.00	1,100.00	780.00
Price (EUR/kg)	0.45	0.25	0.95	0.50
Production value (EUR/are)	652.50	235.00	1,045.00	390.00
Financial results (EUR/are)	123.50	-29.00	325.00	-15.00

Source: According to personal research, Pavlović, 2014.

The aim of business is to decrease the expenses and increase total value of production and work more profitably in this way. The greatest value of production was achieved in organic cucumber growing in greenhouse (1,045.00 EUR/are). Conventional cucumber growing in greenhouse gained 652.50 EUR/are. In organic growing in the open filed, the value of production was 390.00 EUR/are. The value of production was the lowest in conventional growing in the open filed: 235.00 EUR/are. The total costs in the open field in both concepts of growing exceed the value of production, so the losses were recorded both: - 29.00 and -15.00 EUR/are, respectively (Table 2). According to our research, it is possible to gain profit in organic farming in the open field, if the production is increased. Organic cucumber production in greenhouses was more profitable (225.00 EUR/are) than conventional (123.50 EUR/are).

The attractiveness of vegetable production lies in the rapid turnover of capital, which makes it very interesting for small producers (Pavlović et al., 2010).

Economic efficiency is the indicator of economic management. In our research, the coefficient of economic efficiency was 1.23 and 0.89 for conventional and 1.27 and 0.96 for organic concept (Table 3). If the calculated value was higher than 1 the total success of production was higher.

The aim of the economic management is to decrease the costs and to increase total value of production and work more economically efficient.

In our analysis, the conventional growing of slicing cucumber, in greenhouses, on 1,450.00 kg/are, and with selling price 0.45 EUR/kg, the production value was 652.50 EUR/kg. The costs of this production were 529.00 EUR/are, and the gain was 123.50 EUR/are. Conventional production in the open field was with losses (Table 2). Similar results were calculated by Tuzel et al. (2007) and Mohammadi and Omid (2010). On the other hand, organic growing, in the greenhouses, yielded 1,100.00 kg/are and had a price at the market 0.95 EUR/kg, which makes the total value of production: 1,045.00 EUR/are (Table 2). Total costs in this way of production were 820.00 EUR/are, and the gain was 225.00 EUR/are. In this concept of growing, the losses were in the open field production (Table 2).

Table 3. Indicators of profitability of production of conventional and organic slicing cucumber production

Indicators	Conventional		Organic	
	Greenhouse	Open field	Greenhouse	Open field
Total costs (EUR/are)	529.00	264.00	820.00	405.00
Production value (EUR/are)	652,50	235.00	1,045.00	390.00
Cost price (EUR/kg)	0.36	0.28	0.74	0.52
Financial results (EUR/are)	123.50	-29.00	225.00	-15.00
Break-even point (kg/are)	1,175.55	1,056.00	863.20	810.00
Rate of return (%)	18.90	-12.30	21.50	-3.85
Coefficient of cost-effectiveness (e)	1.23	0.89	1.27	0.96

Source: According to personal research, Pavlović, 2014.

Profitability threshold in conventional greenhouse production was 1,175.55 kg. In the organic greenhouse growing, the profitability threshold was 863.02 kg. The difference between yield and profitability threshold, in the first case (274.45 kg/are and 236.80 kg/are) clearly points the profitability of the ways of production mentioned above.

Conclusion

Analytical calculation of slicing cucumber growing, in conventional and organic production, proved that it can be profitable, except when growing in the open field in the conventional concept. Relevant parameters of successful production in conventional concept of growing in greenhouses and in the open field are the coefficient of cost-effectiveness 1.23 and 0.89. In organic concept of growing this coefficient was 1.27 and 0.96. Business rate of profitability for the first concept of growing was 18.90 % and -12.30 %, and in second (organic) 21.50 % and -3.85 %. The highest gain (996 EUR/are), was organic greenhouse production. The only production with losses was conventional open field production. These parameters unequivocally show that producers should turn to organic concept of growing of slicing cucumber.

Acknowledgement

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EKONOMSKA I AGRONOMSKA ANALIZA GAJENJA KRASTAVCA PO PRINCIPIMA KONVENCIONALNE I ORGANSKE BILJNE PROIZVODNJE

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Rezime

Savremenim agrotehničkim merama može se postići visok i stabilan prinos svežeg salatnog krastavca tokom cele godine. U radu su prikazani troškovi proizvodnje, prinos po jedinici površine i osnovni pokazatelji profitabilnosti proizvodnje salatnog krastavca u zaštićenom prostoru i na otvorenom polju, u konvencionalnom i organskom sistemu zemljoradnje. Gajenje u zaštićenom prostoru i u skladu sa principima organske zemljoradnje, proizvođačima omogućava postizanje viših cena na tržištu. Najveći troškovi 820 EUR/a, ali i najveća dobit 225 EUR/are, ostvareni su pri proizvodnji salatnog krastavca u zaštićenom prostoru u organskom sistemu gajenja. Pri gajenju krastavca na otvorenom polju, uprkos nižim troškovima zabeležen je gubitak i u organskom i u konvencionalnom sistemu gajenja, -29 EUR/are odnosno -15 EUR/are respektivno. Vrednosti stope rentabilnosti poslovanja i koeficijenta ekonomičnosti bile su veće pri gajenju krastavca u zaštićenom prostoru kod oba koncepta biljne proizvodnje.

Ključne reči: *krastavac, dobit, stopa rentabilnosti, zaštićen prostor, organska proizvodnja.*

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