

EVALUATION OF COSTS IN ASPARAGUS PRODUCTION IN RELATION TO DIFFERENT TECHNOLOGICAL PROCESSES IN CONDITIONS OF SLOVAK REPUBLIC

Patrik Burg¹, Jana Burgová², Anna Krakowiak-Bal³

¹ Department of Horticultural Machinery, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

² Department of Breeding and Propagation of Horticultural Plants, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

³ Faculty of Production and Power Engineering, Institute of Agricultural Engineering and Computer Sciences, Balicka 116, 30-149 Krakow, Poland

Abstract

BURG PATRIK, BURGOVÁ JANA, KRAKOWIAK-BAL ANNA. 2014. Evaluation of Costs in Asparagus Production in Relation to Different Technological Processes in Conditions of Slovak Republic. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 62(1): 31–37.

This study deals with analysis structure of cost on the production of asparagus in relation to three different technological processes in conditions of Slovak Republic. Obtained results can be used as a template to prepare budgets and make production decisions to estimate potential returns and to analyze investment and financial analysis decisions in the asparagus cultivation. Production practices used in the budget are based on typical practices for asparagus in this country. From the analysis of the cost structure of assessed variants different technological procedures follows that the largest share of the costs fall to purchased material and labor.

Keywords: asparagus, technological system, technological process, cost structure

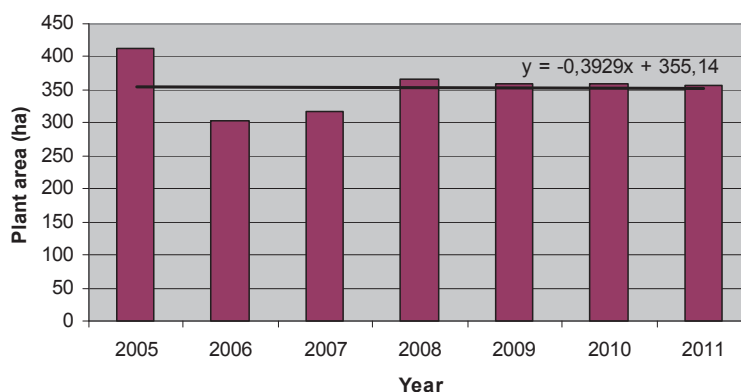
INTRODUCTION

Asparagus is a delicate vegetable, which is grown for etiolate sprouts (white asparagus), or for unbleached sprouts (green asparagus). According to Benson (2009) is asparagus on a global scale grown on 195 819 ha. Up to 35.5% (69 462 ha) of these areas fall to Asia, 28.7% (58 198 ha) to Europe, 17.3% (33 965 ha) to the North America and 16.3% (31 875 ha) to the South America, 1.1% fall on to Australia and New Zealand and 1% to Africa.

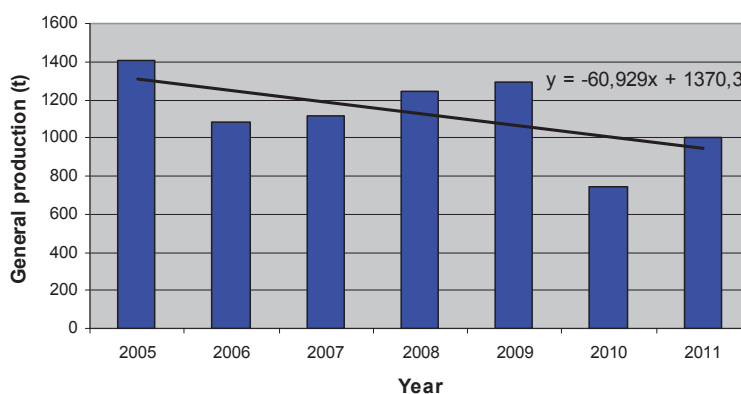
From the total volume of production approximately the 62% of green asparagus and 38% of white asparagus is annually produced (BALL *et al.*, 2001). Specific position in white asparagus production has Europe, where is his participation to 75%. China is a largest producer of asparagus, where is grown on an area of 57 000 ha with an average yield of 12 t.ha⁻¹ (BENSON, 2008). Peru is the second largest producer with average yield of

9.5 t.ha⁻¹. Followed by Germany with 22 000 ha, Spain with 11 000 ha, France (7 000 ha) and Italy (6 000 ha). Average yield in these states ranges from 4 to 9 t.ha⁻¹ (AEGERTER *et al.*, 2007). In the conditions of SR is grown solely white asparagus on an area of 360 ha with an average yield of 7 t.ha⁻¹ and his entire production gets on export (ZÁLEŠÁKOVÁ, 2013). The Fig. 1 and Fig. 2 indicate the development of the size of growing areas and development of the total production of asparagus in Slovakia during the period 2005–2011.

The white asparagus, which is intended to export, is mostly cultivated (MERAVÁ, 2012). Asparagus is still largely grown in the conventional system, although the trend in the past 5 years shows a gradual transition to ecological production system (BENSON, 2008). This condition is caused by the growing worldwide trend forward to the introduction of more careful growing, which is based on the conditions suitable development



1: Development of the size of growing areas in Slovakia



2: Development of the total production of asparagus in Slovakia

(NICHOLS, 2005). In terms of ecological farming in the Slovak, the technological processes are governed by rules that are based from law No. 242/2000 Coll. About ecological farming Law No. 368/1992 Coll., about administrative fees, as amended and law No. 189/2009 Coll., about ecological farm production (ZÁLEŠÁKOVÁ, 2013).

With current methods for growing asparagus is for growers significant the knowledge of the expected costs to the various technological processes (FOLTÝN *et al.*, 2009). Detailed analysis of their structure allows the ways for their reducing.

The aim of this paper is analyze the cost structure to the production of asparagus in relation to three different technological processes in conditions of Slovak Republic.

MATERIAL AND METHODS

Economic evaluation of the asparagus growing presents particularly the assessment of costs, productivity and thereby profitability or conversely unprofitability. The resulting cost of cultivation is given by the total amount of individual costs (GURČÍK, 2000). These can be characterized as a monetary expression the consumption of production factors effective expended on the yield production. According to different criteria can be classified costs most commonly depending on the

type and purpose. Expenses by nature including in particular the following items:

- Consumption of materials, energy and external services
- Personnel cost (salaries, cost of social and health insurance, etc.)
- Depreciation of fixed tangible and intangible assets
- The financial costs.

Division of costs according to the purpose, for which they were expended, is division of costing. Costs are divided into two major groups namely direct and indirect. Direct costs in the final calculation of own costs are finding directly to the appropriate performance and the indirect are assigned to individual performance via fixed allocation base (BUDAY, 2007; CHRASTINOVÁ, 2008).

For a detailed division of costs in the calculation is applicable a general costing model as indicated Tab.I.

Items 1, 2, 3 are calculated as a direct costs to the individual performances. Items 6, 7 and 8 are dissolved indirect costs. For item 5 are calculating directly only depreciation of specialized machinery and equipments or the buildings used for solely to produce a given output. Depreciation of tangible assets, which is used in the production process more

I: Entry of costing formula

Entry of casting formula	
1 Purchased material	Seed for sowing, seedlings, fertilizers, products for plant protection and other direct material
2 Inputs of own production	Seed for sowing, seedlings, fertilizers and other custom products
3 Other direct costs and services	External services, energy, fuel, insurance, rents and ground rents, tax from land, etc.
4 Operational costs	Wage and other personnel costs, including contributions to health and social insurance
5 Depreciation of intangible fixed and tangible assets	
6 The costs of ancillary activities	Costs of their own mechanisation equipments, repairs and maintenance
7 Production overheads	Depreciation of tangible assets, rental, spare parts and materials for repairs and other items common to the plant production
8 Executive overheads	Electrical energy, tangible assets depreciation, rent, interest and the other items common for the whole company

performances, are covered by the relevant share in items 6, 7 and 8. For item 4 – the methodology fully prescribes the labor costs, so that including as both direct costs calculated to each performances and the appropriate share of the wage costs of ancillary activities and overheads.

Besides assessing of costs, is necessary to assessing also profitability of asparagus. Yield represents the monetised equivalent of provided performance, regardless of whether if they were cashed. By this are the yield differ from cash receipts. The main revenue items are sales (GRZNÁR, SZABO, 2005).

The data about the costs and profitability of asparagus were obtained from a sample survey in companies BIOASPA Ltd. and ASPARAGUS Ltd., which are deal with commercial production of asparagus on Slovak. Bioaspa company Ltd. growing asparagus on an area of 250 ha, Asparagus company Ltd. growing asparagus on an area of 70 ha. Additional data were detected in collaboration with the Research institute of agricultural and food economics and from statistical data of the Ministry of agriculture and rural development of the Slovak Republic.

Individual costs and revenues items are calculated as average of values per period 2010–2013. The total costs are dividend to scheduled calculation units using several methods. In the growing of asparagus when it comes to the production process with a single product, is used calculation method by dividing (total costs are divided of product produced quantity). These costs per unit of production are expressed in the text as product costs.

Costs analysis is complemented by an analysis of the indicators of profitability rate calculated by the formula [1]:

$$\begin{aligned} \text{rate of profitability} &= \\ &= \frac{\text{procuotion price} - \text{cos ts of product}}{\text{production cos ts}} \times 100 (\%). \end{aligned} \quad [1]$$

In the calculations profitability of asparagus growing was used the average exercise price as a production cost and the price of agricultural

producers. The average exercise price is taken from a sample survey of costs of agricultural products, processed in the Research institute of agricultural and food economics. Is also used in the calculation indicators of the rate of profitability 1. Price of agricultural producers is average price over the period obtained in the sample survey of Statistical Office of the SR. This agricultural producer's price was used to calculate the rate of profitability 2 and is used to compare of fluctuations that occur in the prices.

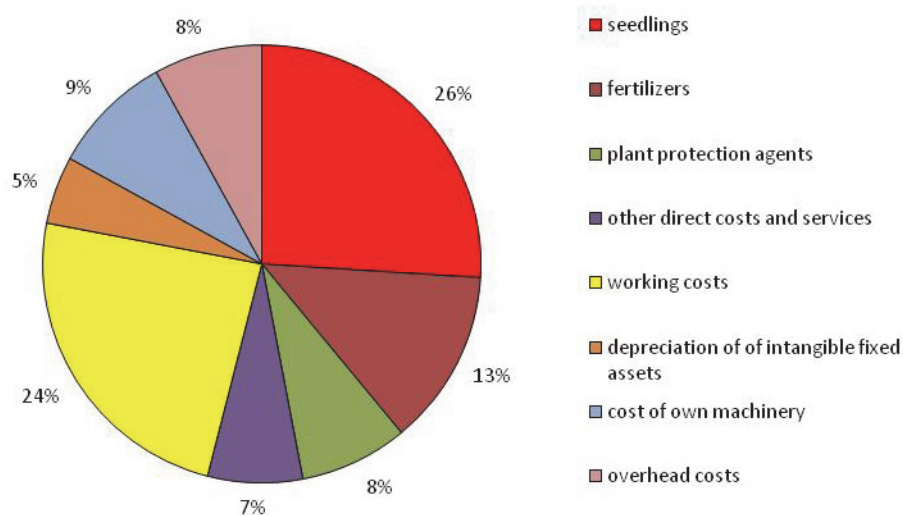
RESULTS AND DISCUSSION

In the assessment of costs were included three different technological procedures applied in the cultivation of asparagus, which are used in the investigation of subjects included in the sample surveys. It is a technological process for the production of green asparagus, white asparagus by classical way on ridges and white asparagus on ridges sheltered by tunnels from the transparency film.

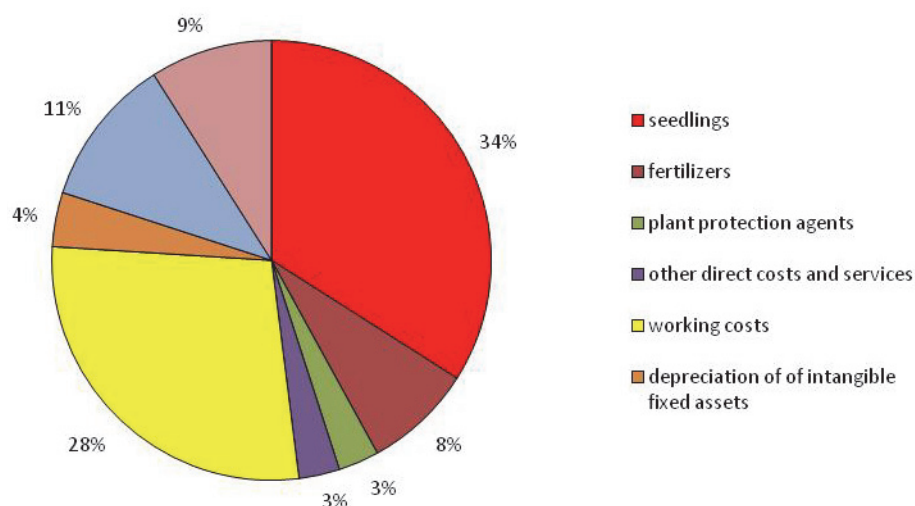
The results indicate that the cost structure in the cultivation of green and white asparagus differs significantly. The main reason for these differences is the different representation of working operations within the applied technological processes, the different requirements for human labor and the different costs to material inputs. Similar cost structures have technological procedures applied in the cultivation of white asparagus (classic method on ridges, technique on ridges with tunnels from transparency film).

Fig. 3 shows the structure of the cost in the costs in the cultivation of green asparagus. Total costs are reaching levels of 6 500 euro.ha⁻¹. As with most vegetable species, the labor costs constitute the largest item in the total costs to cultivation of green asparagus. They represent at an average 24% and ranging about 1 570 euro.ha⁻¹.

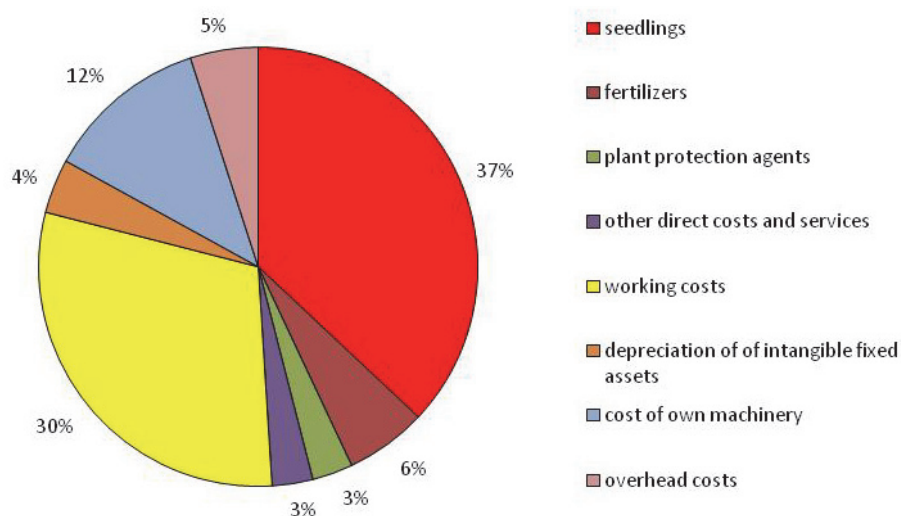
Fig. 4 shows the structure of the costs at cultivation of white asparagus by the classic way on ridges. The total cost in this variant of technological



3: The cost structure in the growing of green asparagus



4: The cost structure in the growing of white asparagus on ridges



5: The cost structure in the growing of white asparagus on ridges with tunnels from transparent film

process achieves level of 13 700 euro.ha⁻¹. Major cause of increased costs are the requirements for mechanized profiling of ridges, their adjustment and covering the black and white polyethylene film, which prevents access of light and supports the shoots whitening. As in the previous case seems high proportion to labor costs (28%) and machinery (11%).

RUTHERFORD (1995) in his analyzes in conditions of the U.S. quantify the labor costs as the highest proportion, which make up 35% of total production costs. Similarly GEYER *et al.* (2002) shows the proportion of labour consumption in terms of Germany up to the level 39% of the total costs.

In the cultivation of white asparagus on ridges with tunnels from transparent film (Fig. 5) is a cost structure similar to that of the cultivation of white asparagus on ridges and reaches a level of 16 000 euro.ha⁻¹. Additional costs increase is due to the requirements for the acquisition of two kinds of film. The first type is used to covering ridges similarly to previous method, the second type of transparent film is installed to a support structure located above the ridges and is used to increase the temperature that promotes the growth and development of shoots.

Asparagus belongs to the crops with very high total costs per hectare of growing area as indicated the average values in Tab. II. Higher total costs to 1 ha of harvested area and relatively low yields per hectare causes high product costs per tonne of asparagus.

MAYBERRY (2000) and SMATHERS (2007) deals with the issue of evaluating the costs in terms of growing asparagus in the U.S. and evaluated the total costs the amount of 11 850 \$.ha⁻¹ and 12 700 \$.ha⁻¹, what corresponding to the amount of 8 500–9 150 €.ha⁻¹. GEYER *et al.* (2002) reported that the costs to 1 kg of shoots in terms of FRG are mowing at level of 1.7 €, which with expected yield of 7 t.ha⁻¹ represents a costs in the amount of 11 900 €.ha⁻¹.

According to the economic analysis which was performed by NEIBERGS and WATERS (2009) the costs of cultivation of green asparagus were ranging at level of 10 200 \$.akr⁻¹, which represents the amount around of 7 300 €.ha⁻¹.

From the comparison of product costs and average exercise price and from the calculated rate of profitability 1 implies that asparagus grown in all variants of technological processes is profitable vegetables. The rate of profitability 2 calculated on the basis of the average product costs and prices of agricultural producers, shows several times greater profitability. When evaluating the economy of asparagus growing based in information contained in Tab. I, it is necessary to take into account that the rate of profitability 1 shows the average actuality achieved in the sample of respondents. The rate of profitability 2 shows the options that arise from price levels within the whole SR (CHRASTINOVÁ, 2008). With better monetization on level of average prices of agricultural producers, the asparagus can be very profitable vegetables.

From the results shown in Tab. I is also clear that in the cultivation of green asparagus is possible to achieve lower yield and the exercise price, which is caused minor interest of consumers in the domestic and European market.

On the contrary, the cultivation of white asparagus in both cases is reaching earlier harvests, higher yield and better quality of shoots, which is also positively, translates into the exercise prices of agricultural producers.

CONCLUSION

This paper deals with the analysis of the cost structure of the asparagus production in relation to three different technological processes in terms of Slovak Republic. The three variants of technological processes were assessed – the cultivation of green asparagus, cultivation of white asparagus by the classic way on the ridges and growing of white asparagus on the ridges with tunnels from

II: Economic evaluation of technological processes for growing asparagus

Item	Growing of green asparagus	Growing of white asparagus on ridges	Growing of white asparagus on ridges with foil tunnels
Total costs (€.ha ⁻¹)	6 540	13 720	16 030
Yield per hectare (t.ha ⁻¹)	5	7	8
Product costs (€.t ⁻¹)	1 308	1 960	2 003
Average sales price (€.t ⁻¹)	2 000	2 600	2 600
Production yields (€)	13 000	20 160	25 600
Subsidy titles (€)	606	606	606
Total revenues (€)	13 606	20 766	26 206
Economic result (€)	7 066	7 046	10 179
Minimum yield for a zero return (t)	2.5	4.8	5.0
Rate of profitability 1 (%)	53	33	30
Prices of agricultural producers (€.t ⁻¹)	2 640	2 880	3 200
Rate of profitability 2 (%)	101	47	60

transparent film. From the analysis of the cost structure of assessed variants of technological procedures follows that the largest share of the costs fall to own machinery (9–12%), purchased material (26–37%) and labor (24–30%). Just a high proportion of manual labor is caused by the traditional thinning way of harvesting shoots. The total costs to production of green asparagus then move at level 6 540 €·ha⁻¹, the growing of white asparagus by the classic way on ridges at level 13 720 €·ha⁻¹ and

the growing of the white asparagus on ridges with tunnels from transparent film around 16 030 €·ha⁻¹. Return of the asparagus production is influenced by the reached market price. The average sales price of the sample survey shows that, the achieved price, including subsidies significantly affects the rate of profitability. With better monetization of average prices of agricultural producers, the asparagus can be very profitable crop.

SUMMARY

This study deals with analysis structure of cost on the production of asparagus in relation to three different technological processes in conditions of Slovak Republic. Obtained results can be used as a template to prepare budgets and make production decisions to estimate potential returns and to analyze investment and financial analysis decisions in the asparagus cultivation. Production practices used in the budget are based on typical practices for asparagus in this country. The results show that the total costs to production of green asparagus move at level 6 540 €·ha⁻¹, the growing of white asparagus by the classic way on ridges at level 13 720 €·ha⁻¹ and the growing of the white asparagus on ridges with tunnels from transparent film around 16 030 €·ha⁻¹. From the analysis of the cost structure of assessed variants different technological procedures follows that the largest share of the costs fall to purchased material and labor.

REFERENCES

- AEGERTER, B., KLONSKY, K. M., DEMOURA, R. L., 2007: *Sample Costs to Establish and Produce Asparagus*. San Joaquin Valley: University of California Cooperative Extension. 142 p. ISBN 0 7245 3007 X.
- BALL, T., FOLWELL, R. J., HOLMES, D., 2001: *Establishment and Annual Production Costs for Washington Asparagus*. Farm Business Management Reports. EB pp. 1779, Cooperative Extension Washington State University.
- BENSON, B. L., 2008: 2005 update of the world's asparagus production areas spear utilization, yields and production period. Proc. of 11th Int. Asparagus Symp. Ed. J. H. Mulder et al. *Acta Hort.*, 776: 495–507. ISSN 0139-570X.
- BENSON, B., 2009: *Update of the world's Asparagus production areas, spear utilization and production period*. In: Calif-asparagus-seed.com.
- BROOKS, J., DYER, G., TAYLOR, E., 2008: *Modelling Agricultural Trade and Policy impacts in Less Developed countries*. OECD Food, Agriculture and Fisheries Working Papers No. 11, publishing, OECD. Doi: 10.1787/228626403505.
- BUDAY, Š., 2007: Agricultural land market in Slovakia. *Agricultural Economics – Czech*, 53: 146–153. ISSN 0139-570X.
- FOLTÝN, I., KOPEČEK, P., ZEDNÍČKOVÁ, I., VÁVRA, V., 2009: Profitability development of key agricultural commodities in 2002–2006. *Agricultural Economics*, 55: 181–199. ISSN 0139-570X.
- GEYER, M., OBERBARNSCHEIDT, B., PASCHOLD, P. J., 2002: Non selective harvest of white asparagus. Fruit, Nut, and Vegetable Production Engineering. *Proceedings of the 6th Int. Symposium*, Potsdam: ATB, 227–232, ISBN 3-00-008305-7.
- GRZNÁR, M., SZABO, L., 2005: Výkonnosť a produktivita poľnohospodárstva a poľnohospodárskych podnikov (Performance and productivity of agriculture and agricultural enterprises.). *Ekonomika poľnohospodárstva*, 5, 1: 23–28. ISSN 1338-6336.
- GURČÍK, L., 2000: Faktorová analýza rozkladu hospodárskeho výsledku vo vybranom súbore poľnohospodárskych podnikov (Factors analyze of profit decomposition in chosen agricultural companies). In: *Zborník vedeckých prác z Medzinárodných vedeckých dní 2000 Agrárna politika, ekonomika a právo*. Nitra: SPU Nitra, 2, pp. 262–267; ISBN 80-7137-716-3.
- CHRASTINOVÁ, Z., 2008: Economic differentiation in Slovak agriculture. *Agricultural Economics – Czech*, 54, 11: 536–545. ISSN 0139-570X.
- MERAVÁ, E., 2011: *Zelenina: Situačná a výhládová správa. Ministerstvo pôdohospodárstva a rozvoja vidieka Slovenskej republiky*. 16. jún 2012. 78 s. ISSN 1338-8010.
- MAYBERRY, K. S., 2000: *Sample cost to establish and produce Asparagus*. University of California and the US Department of Agriculture cooperating. Available online: www.agribusiness-mgmt.wsu.edu.
- NICHOLS, M. A., 2005: Asparagus-the world scene. Proc. of 7th Int. Asparagus Symp. Ed. A. Falavigna et al. *Acta Hort.*, 271: 25–31. ISSN 0567-7572.
- NEIBERGS, J. S., WATERS, T., 2009: *Estimated Costs and Returns for Establishing and producing Asparagus in Washington in 2009*. Pullman, WA: School of Economic Sciences, SE Extension District, Washington State University Extension. Available online: www.agribusiness-mgmt.wsu.edu.
- RUTHERFORD, P., 1995: *Asparagus Culture: Production, Management and Marketing*. Small Farm Today.

- December. Available online: <http://openagricola.nal.usda.gov/Record/IND20560731>.
- SMATHERS, R., 2007: *Costs of Owning and Operating Farm machinery in the Pacific Northwest*. PNW0346, Pacific Northwest Extension Publications. Available online: www.cals.uidaho.edu/edcomm/pdf/PNW/PNW0346/PNW346.pdf.
- ZALAI, K., 2008: *Finančno-ekonomická analýza podniku (Financial-economic analyze of company)*. Bratislava: Sprint VFRA, 385 s. ISBN 978-80-89085-99-6.
- ZÁLEŠÁKOVÁ, I., 2013: *Hodnotenie pracovných operácií a mechanizačných prostriedkov využívaných pri pestovaní špargle*. ZF MENDELU: Závěrečná práce. 73 s.

Contact information

Patrik Burg: patrik.burg@seznam.cz
Jana Burgová: janamok@centrum.cz
Anna Krakowiak-Bal: Anna.Krakowiak-Bal@ur.krakow.pl