

AGROECONOMIC ANALYSIS OF APRICOT PRODUCTION IN EARLY YEARS AFTER PLANTING

Ivan GLISIC^{1*}, Tomo MILOSEVIC¹, Nebojsa MILOSEVIC², Radmila NIKOLIC¹, Gorica PAUNOVIC¹

¹Faculty of Agronomy, University of Kragujevac – Zaječar, Serbia

²Fruit Research Institute, Zaječar, Serbia

*Corresponding author: glishoo@yahoo.com

Abstract

This paper presents the results of an analysis of economic effects (costs and income) of apricot production during the first 7 years after planting. The analysis involved an orchard of apricot cv. 'Roxana' grafted onto 'Myrobalan' (*Prunus cerasifera* Ehrh.) seedling rootstock and grown at a plant spacing of 6 x 3.5 m (476 trees/ha). Since 'Roxana' is primarily a fresh market cultivar, income was calculated based on the fresh apricot market price (the average price for the last 3 years 0.5 €/kg). Production costs included material input costs, labour costs and machinery operating costs. Results showed that orchard establishment costs were 2,980.00 €/ha. Orchard management costs increased continuously from year 1 to 6 of orchard life (565 € 865 € 1,145 € 1,470 € 1,840 € and 2,600 €/ha in the 1st through 6th growing seasons, respectively). Cumulative costs until the start of the 7th growing season were 11,465 €/ha. The first yield (1.15 t/ha) and, hence, the first income (575 €/ha) were achieved in the 3rd growing season. During the 4th, 5th and 6th years after planting, there was an increase in yield (4.50 t/ha, 9.33 t/ha and 16.75 t/h) and, accordingly, in the income gained (2,250 €, 4,665 € and 8,370 €, respectively). Cumulative income until the start of the 7th growing season was 15,860 €/ha. Return on investment and the first positive balance in apricot production for fresh use were attained in the 6th growing season after planting.

Key words: *apricot, agro-economic analysis.*

Introduction

Apricots are generally cultivated in the Northern Hemisphere. In the Mediterranean and Central Asia, they account for more than 80% of the world's production (Milatovi , 2013). The world's leading apricot producers are Turkey, Iran, Uzbekistan, Italy and Pakistan (FAOSTAT, 2012). These 5 countries produce half of the world's apricot production. In Europe, Italy is the largest apricot producer, followed by France, Spain and Greece. Serbia ranks among 10 apricot producers in Europe in terms of average annual production. The production is characterised by high yield fluctuations across years. In the last 10 years, apricot yield ranged from 13,409 - 40,754 t. The main causes of variations in apricot production include late spring frosts and sudden wilting (Milošević et al., 2008). Moreover, additional reasons for yield variations are winter kill of flower buds before blooming (Miletić et al., 2006; Milatović et al., 2013), absence of proper management practices and low-intensity cultivation methods (Milošević et al., 2011). Nevertheless, under Mediterranean conditions and in temperate continental climates, variations in apricot production are mostly due to unstable winter and early spring temperatures (Rodrigo and Herrero, 2002). Marked variation in apricot yield across years leads to highly variable cost-effectiveness of apricot production (Veljković et al., 2009). Investment costs are also generated during the years when yields and, hence, income are reduced. High-intensity growing methods can ensure early bearing, a fast return on investment and somewhat reduced instability of the cost-effectiveness of apricot

production. The objective of this study was to analyse the cost-effectiveness of apricot production in a high-intensity orchard during early years after planting by comparing orchard establishment and management costs with the income gained.

Material and methods

The study was conducted in an apricot orchard located at the village of Prislonica near Čačak (Serbia), a well-known apricot production centre. The municipality of Čačak covers only 0.7% of the total area of the Republic of Serbia, but it accounts for as high as 10-15% of the total apricot production in Serbia.

The analysis involved a high-intensity orchard of apricot cv. 'Roxana' grafted onto Myrobalan seedling rootstock (*Prunus cerasifera* Ehrh.) and grown at a plant spacing of 6 × 3.5 m (476 trees/ha). The research was conducted over a period of 6 years (from year 2008 to year 2013) i.e. from the orchard establishment date until the beginning of the 7th growing season.

Production costs were divided into orchard establishment costs and orchard management costs during the 1st through 6th growing season. Management costs included material input costs, labour costs and machinery operating costs. Income was calculated by multiplying the yield of apricot by its market price. Since 'Roxana' is primarily a fresh market cultivar, income was calculated based on the fresh apricot market price (the average price for the last 3 years 0.5 €/kg). Relating income to production costs gives the cost-effectiveness of apricot production in early years after planting i.e. the answer to the question as to when the return on investment and the first positive balance in apricot growing are attained.

Results and discussion

Notwithstanding its marked variation in Serbia across years, apricot production showed a slight tendency to increase annually during the first decade of the 21st century. The increase in apricot production is the result of new growing methods used (Milošević et al., 2012) and new apricot orchards established. 'Roxana' is among cultivars commonly found in new apricot orchards (Milošević et al., 2013). This cultivar also plays an important role in new apricot orchards in Hungary (Szabó et al., 2011). Newly established apricot orchards have narrow plant spacings, a high number of trees per unit area, and a low crown volume. Establishment costs for such an orchard were calculated, involving 480 trees per ha i.e. a plant spacing of 6 x 3.5 m. Orchard establishment costs are presented in Tables 1, 2 and 3.

Tab. 1. Material input costs for the establishment of a 1 ha apricot orchard

| | Material input | Amount | Unit price | Total price |
|----------------------|---|------------|------------|-------------|
| 1. | Manure | 45 t | 5 € | 225 € |
| 2. | Stakes used for planting | 50 pcs. | 0.3 € | 15 € |
| 3. | Markers used for planting | 1,440 pcs. | 0.01 € | 15 € |
| 4. | Rope used for planting | 8 pcs. | 4 € | 32 € |
| 5. | Apricot plants | 480 pcs. | 2.5 € | 1.200,00 € |
| 6. | Mineral fertiliser | 50 kg | 0.5 € | 25 € |
| 7. | Plastic mesh to protect against rodents | 100 m | 1 € | 100 € |
| Total material input | | | | 1,612.00 € |

Material input costs for establishing a 1 ha apricot orchard are 1,612.00 € Material inputs do not include irrigation system and anti-hail net, but rather the items that are found in most apricot orchards in Serbia.

Labour costs for the establishment of a 1ha apricot orchard are given in Tab. 2. .

Tab. 2. Labour costs for establishing a 1 ha apricot orchard

| | Operation | Volume of work | Unit price | Total price |
|--------------|--|----------------|------------|-------------|
| 1. | Soil analysis | 6 samples | 20 € | 120 € |
| 2. | Spacing | 18 h | 5 € | 90 € |
| 3. | Loading and unloading of plants and fertiliser | 4 h | 2 € | 8 € |
| 4. | Planting (physical) | 100 h | 2 € | 200 € |
| 5. | Planting (professional) | 30 h | 5 € | 150 € |
| 6. | Irrigation | 12 h | 2 € | 24 € |
| 7. | Protection against rodents | 18 h | 2 € | 36 € |
| Total labour | | | | 628.00 € |

Total labour costs for establishing a 1 ha apricot orchard are 628 € The calculation was made by taking the average labour price in Serbia of about 2 €for physical activity and 5 €for professional engagement.

Machinery operating costs for establishing a 1ha apricot orchard are presented in Tab. 3.

Tab. 3. Machinery operating costs for establishing a 1 ha apricot orchards

| | Operation | Volume of work | Unit price | Total price |
|---------------------------------|--|----------------|------------|-------------|
| 1. | Loading and broadcasting of manure (the price given for a 3 t trailer) | 15 trailers | 10 € | 150 € |
| 2. | Deep ploughing | 1 ha | 350 € | 350 € |
| 3. | Disking or harrowing | 1 ha | 120 € | 120 € |
| 4. | Transport of plants and mineral fertilisers | 1 conveyance | 50 € | 50 € |
| 5. | Supply of irrigation water | 7 cisterns | 10 € | 70 € |
| Total machinery operating costs | | | | 740.00 € |

Machinery operating costs in establishing a 1 ha apricot orchard are 740.00 € The primary role of the machinery used to establish the orchard is to prepare the soil for planting (deep ploughing, final soil preparation for planting through disking or harrowing), and to be engaged for different transportation purposes.

Total costs of establishing a 1 ha apricot orchard are the sum of material input costs, labour costs and machinery operating costs, a presented in Tab. 4.

Tab. 4. Total costs of establishing a 1 ha apricot orchard

| | Type of cost | Total price |
|-------|--------------------------|-------------|
| 1. | Material input costs | 1,612.00 € |
| 2. | Labour costs | 628.00 € |
| 3. | Machinery operating cost | 740.00 € |
| Total | | 2.980,00 € |

Total establishment costs for a 1 ha apricot orchard (without an irrigation system and anti-hail net) are 2,980.00 €. Total establishment costs for a 1 ha apricot orchard are significantly lower than in apple (Subić et al., 2011) or raspberry (Veljković et al., 2006), and similar to those for plum (Milošević et al., 2008).

Management costs during the 1st growing season were 565 € and largely included costs of pruning, additional fertilisation, soil tillage and disease and pest control. Management practices during the 2nd growing season were the same as in the 1st growing season, with the volume of work and, hence, costs increased to 865 €. In the 3rd growing season, the apricot orchard produced its first yield. From the 3rd through 6th growing seasons, the yield steadily increased, thus resulting in increased costs, primarily due to harvest costs and pest and disease control costs. The costs were: 1,145 €, 1,470 €, 1,840 € and 2,600 € in respective growing seasons.

Yield and, hence, income, increased from the 3rd to 6th growing season. The first yield was attained in the 3rd growing season – 1.15 t/ha, and substantial yield was obtained in the following i.e. 4th growing season – 4.5 t/ha. The results are in agreement with those of (Čurić and Keserović, 2007) who found that first major yields in apricot can be produced in the 4th growing season, or during the 3rd at the earliest. This yield enabled the first income (575 € and 2,250 € in the 3rd and 4th growing seasons, respectively). The yield was significantly higher in the 5th growing season (9.33 t/ha), and particularly in the 6th growing season (16.75 t/ha), when it approached optimal values per hectare in apricot for fresh use. These yields also brought about significant income (4,665 € in the 5th growing seasons and 8,370 € in the 6th growing season).

A comparison between costs and income in a 1ha apricot orchard during the first 6 growing seasons is presented in Tab. 5.

Tab. 5. A comparison between costs and income in a 1 ha apricot orchard during the first 6 growing seasons

| | Costs (€/ha) | | Income (€/ha) | | Balance (€/ha) B-A |
|----------|-----------------------|-----------|-----------------------|-----------|-----------------------|
| | In the year specified | Total (A) | In the year specified | Total (B) | |
| planting | 2,980 | 2,980 | 0 | 0 | -2,980 |
| 1st year | 565 | 3,545 | 0 | 0 | -3,545 |
| 2nd year | 865 | 4,410 | 0 | 0 | -4,410 |
| 3rd year | 1,145 | 5,555 | 575 | 575 | -4,980 |
| 4th year | 1,470 | 7,025 | 2,250 | 2,825 | -4,200 |
| 5th year | 1,840 | 8,865 | 4,665 | 7,490 | -1,375 |
| 6th year | 2,600 | 11,465 | 8,370 | 15,860 | +4,395 |

Until the beginning of the 3rd growing seasons, the apricot orchard generated only costs – 4,410 € (cumulative, planting costs + management costs in the 1st and 2nd growing seasons). In the 3rd growing season, the first yield (income) was obtained, but it was lower than

production costs in this year, indicating further increase in the negative balance during the 3rd growing season (- 4,980 €).

During the 4th growing season, the income (2,250 €) was for the first time higher than the costs during the year (1,470 €), but the total balance remained negative (- 4,200 €). The tendency to decrease the negative balance continued into the 5th year and at the end of the 5th growing season it was - 1,375 €. During the 6th year, substantial income (8,370.00 €) was gained. This resulted in the first positive balance in the 6th year, i.e. it was the first time in the 6th year that total income was higher than total costs. Return on investment and the first profit are made in the 6th growing season.

The cost-effectiveness of apricot production is largely dependent on the frequency of late spring frost events. It is noteworthy that there were no late spring frosts during the experimental years.

Conclusion

The results of the agro-economic analysis of apricot cultivation in early years after planting suggest the following:

Establishment costs for a 1 ha apricot orchard are significantly lower than those in some other fruit species such as apple or raspberry.

During the first 2 years of orchard life, total costs increased to include orchard management costs in the 1st and 2nd year. In the 3rd, 4th and 5th growing seasons, first yields and, hence, income, are attained, but in cumulative terms the costs are still higher than the income attained.

During the 6th growing season, return on investment is gained, the value of the production becomes higher than the total costs, and the first profit is reported.

Acknowledgement

This study is part of the Project Ref. No. TR 31064 (“Creation and Preservation of the Genetic Potential of Temperate Fruits”) financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia. We acknowledge the financial and other types of assistance provided by the Ministry in implementing the project tasks.

References

- Djuri B., Keserovi Z. (2007): Gajenje kajsije (Growing apricots). Poljoprivredni fakultet, Novi Sad.
- FAOSTAT, 2012. <http://faostat.fao.org>; Accessed 20. 06. 2014.
- Milatovi D. (2013): Kajsija (Apricot). Nau no vo arsko društvo Srbije. a ak.
- Milatovi D., urovi D., Zec G. (2013): Osetljivost sorti kajsije na zimski i pozni prole ni mraz (The sensitivity of apricot cultivars to winter and late spring frosts). Zbornik radova IV Savetovanja „Inovacije u vo arstvu“, Beograd: 239-247.
- Mileti R., Mitrovi M., Raki evi M., Blagojevi M. (2006): Uticaj niskih zimskih temperatura na izmrzavanje cvetnih pupoljaka breskve i kajsije na podru ju a ka (The effect of low winter temperatures on the freezing of flower buds of peach and apricot in the area of Cacak). Zbornik radova XXI Savetovanja: Unapre enje proizvodnje vo a i grož a, Grocka, 12: 10-16.
- Miloševi T., Gliši I., Veljkovi Biljana, Gliši Ivana, Paunovi Gorica, Miloševi N. (2008): Osnovni uzroci variranja proizvodnje kajsije (The main causes of variation in apricot production). Zbornik nau nih radova XXIII Savetovanja: Unapre enje proizvodnje vo a i grož a, Grocka, 14 (5): 21-31.
- Miloševi T., Miloševi N., Gliši I. (2011): Influence of Stock on the Early Tree Growth, Yield and Fruit Quality Traits of Apricot (*Prunus Armeniaca*, L.). Journal of Agricultural Sciences, 17 (3): 167-176.

- Milošević T., Milošević N., Glišić I. (2012): Effect of tree conductance on the precocity, yield and fruit quality in apricot on acidic soil. *Revista Ciencia Agronomica*, Vol. 43 (1): 177-183.
- Milosevic T., Zornic B., Glisic I. (2008): A comparison of low-density plum plantings for differences in establishment and management costs, and in returns over the first three growing seasons - a mini-review. *Journal of Horticultural Science & Biotechnology* 83 (5): 539-542.
- Milošević T., Milošević N., Glišić I. (2013): Tree growth, yield, fruit quality attributes and leaf nutrient content of 'Roxana' apricot as influenced by natural zeolite, organic and inorganic fertilizers. *Scientia Horticulturae*, 156 (6): 131-139.
- Rodrigo M., Herrero J. (2002): Effect of pre-blossom temperatures on flower development and fruit set in apricot. *Scientia Horticulturae*, 92: 125-135.
- Subić J., L. Nastić, Jelenc M. (2011): Dinamička ocena efekata investiranja u podizanje zasada jabuke (Dynamic assessment of the effects of investment in planting apples). *Zbornik naučnih radova Instituta PKB Agroekonomik* 17 (5): 59-68.
- Szabó Z., Szani Z., Kiss G., Ahmed E., Veres E., Takács-Hájos M., Szalay L., Soltész M., Nyéki J. (2011): Changes of the apricot variety choice in Hungary. *Zbornik radova IV Savetovanja „Inovacije u voštvarstvu“*, Beograd: 99-116.
- Veljković B., Petrović S., Leposavić A., Glišić I. (2006): Profitabilnost proizvodnje maline na području Srbije (Profitability of raspberry production in Serbia). *Ekonomika poljoprivrede*, LIII (4): 1013-1022.
- Veljković Biljana, Milošević T., Glišić I., Paunović Gorica (2009): Some Aspect of Apricot Production in Serbia. *Acta Agriculturae Serbica*, XIV, 28: 83-89.