Economic Efficiency of Olive Growing

Stipe RADINOVIĆ[1]
Josip GUGIĆ[1]
Zoran GRGIĆ[2]

SUMMARY

Olive growers need relevant information about economic justifications of their investments in the construction of new olive groves, and about economic effects of olive growing. In that context, the purpose of the research is the analysis of an investment in olive grove establishment and of the economic indicators of production of olives in full growth. The purpose is to establish the economic justification of investments in the olive groves establishment, and to establish the economic effectiveness of olive growing. In the course of work, the method of simulation modelling was applied. For the purpose of the research, a deterministic simulation model was constructed, consisting of a sub-model of olive grove establishment, and a sub-model of olive growing. Total investment value of 1 hectare of olive grove establishment amounts to 65,500 kn. Profit evaluation indicates that investment of 1 hectare of olive grove establishment is economically justifiable. An olive grove, 1 hectare large, in one year of full yield, makes a profit in the amount of 34,751 kn, and the olive grower has to evaluate if the economic results satisfy his expectations for the work he put in.

[1] Institute for Adriatic Crops and Carst Reclamation
Department of Applied Sciences
Put Duilova 11, 21000 Split, Croatia
[2] Faculty of Agriculture, University of Zagreb
Department of Farm Management
Svetošimunska cesta 25, 10000 Zagreb, Croatia
E-mail: stipe@krs.hr

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INTRODUCTION

Olive growing represents a considerable potential in agricultural production of Mediterranean area in Croatia. In Mediterranean agriecological region, olive is the most spread fruit crop.

Due to the Croatian Central Bureau of Statistics' (CBS) data, total olive-grove area in 2001 was 15638 ha, taking share of 6.8% of the total arable area and 56% of area under orchards in Croatian Mediterranean area. Family farms own 98.3% of olive-groves, and only 1.7% is owned by legal business entities, which responds to the ownership structure in leading olive-growing countries. Croatia has about 42,000 family farms dealing with olive growing; out of that number, about 36,000 are in Dalmatia.

Total number of olive trees in 2001 was 3,413,000, while the number of fruitful trees was 2,993,000 (CBS, 2002). However, out of total number of olive trees, only 30% are in favourable biological and productive condition (Kovačević and Perica, 1994). Total olive production in the period 1997-2001 ranged from 10,405 to 35,200 t, and yield per tree from 3.4 to 11.6 kg. Production of olive oil in the same period ranged from 1,572 to 5,285 t (CBS, 2002). Total production for 2002 production year was assessed on 35,000 t, and oil production on 5,250 t. Great fluctuations of production in different years indicate on prevailing extensive way of production. Regarding this, it is important to stress that in Croatia only 2% of olive groves are irrigated, which is also one of the reasons of fluctuated, unstable and low yields.

Due to data of the Department of seed and seedling growing of the Republic of Croatia, in 2001 was produced 189,076 olive seedlings, which is considerable increase comparing to the previous year when 59,590 seedlings was produced. In Croatia there are 10 olive nursery gardens and 16 registered firms producing olive trees seedlings.

Recently, considerable capacities were built for processing olives into oil, and some old plants were replaced. Currently, there is 112 oil plants in Croatia, of which 74 are privately owned, and 38 are in co-operative ownership (Co-operative Alliance of Dalmatia, 2002). Within most of the oil plants installed are modern lines for continuous way of processing by cold procedure of centrifugal extraction. Daily capacities of the separate plants are 2-40 t. Current processing capacities of 860-900 t of olives per day satisfy Croatian needs, which means that for processing of the total olive production are needed 20 to 40 days.

Olive oil market in Croatia is unorganized, with high share of grey market. Olive oil consumption shows growing trend recently, which is the result of popularization and improved quality of that oil. Olive oil consumption per capita in Croatia is about 1 kg, with great differences in consumption between continental and Mediterranean part of the country. Total annual consumption is about 4,400 t.

Production-consumption balance sheets for olive oil are mostly negative, that is, due to the International Council for olive oil classification, Croatia is in B group of countries that consume more of the olive oil than produce.

Recently, there is a growing interest for building new olive groves, renewal of old ones and those damaged in fire, applying contemporary agritechnical and elaiotechnical procedures in production, building modern olive oil plants and improving the olive oil quality.

However, olive growers need relevant information on economic justifiability of investments into construction of the olive groves, as well as on economic results of olive production. Regarding this, the purpose of the research is to analyse the investment into olive grove construction and of economic indicators of production of olives in full fertility, with the aim of determination the economic justifiability of investing into olive grove construction and economic efficiency of the full fertility olive growing.

MATERIAL AND METHODS

The applied method in the work was the method of simulation modelling. For the purpose of the research, a deterministic simulation model was constructed, consisting of a sub-model of olive grove establishment, and a sub-model of olive growing. Sub-models have been constructed on the basis of determined assumptions taking into consideration biological cycle of olives and technological requirements (Kovačević and Perica, 1994).

The model is constructed on the following assumptions: olive grove area 1 ha; number of olive trees 304; production orientation: 100% production of olives for processing into oil; growing type: intensive growing; varieties: Oblica 60%, Leccino 30%, Levantinka 10%. Family farm has business as physical person and has one farmer, full-time employed. The family farm owns its own small mechanization (motor cultivator 5 kW and motor portable sprayer); machine work costs are calculated as a mechanization service; costs didn't include labour costs. Investments sources: loan 45,500 (credit terms: grace period of 3 years, 7 years for the return, 5% annual interest rate[1]); subsidy for olive grove construction 20,000 Kn[2]; economic lifetime of the investment 10 years.

Constructed sub-models have been basis for calculation of investment and production costs, total revenue

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[1] Official Gazette of the Republic of Croatia (NN 85/01)
[2] Official Gazette of the Republic of Croatia (NN 87/02)

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and other economic indicators (payback period, net present value, internal rate of return, profit, break even price and break even yield). Estimate of the economic profitability is made by the methods based on the payback period, net present value and internal rate of return on the basis of data from the economic flow.

The payback period is calculated by cumulating of net revenues in the economic flow. The year in which the cumulative of the net revenues is positive for the first time is the year of return of the investment.

Net present value is calculated as follows:

$$NPV = -I + \Sigma \frac{NR_n}{\left(1 + \frac{p}{100}\right)^n} \qquad (1)$$

where NPV is net present value, I – investment costs (costs of olive grove construction), NR – net revenues in the economic flow, p – discount rate and n – year.

Internal rate of return is calculated by the method of interpolation due to the equation:

$$IRR = A + \left(\frac{(B-A) \times C}{(C-D)}\right) \qquad (2)$$

where IRR is internal rate of return, A – discount rate under which is NPV positive for the last time, B – discount rate under which is NPV negative for the first time, C – NPV under the discount rate A and D – NPV under the discount rate B.

Calculations were made in computer program MS Excel 2000.

Consumption standards (of material, machinery and labour) used in the models are based on relevant technological standards (Mikšić et al., 2001), investment projects' data (Institute for Adriatic Crops, 1985; Radinović et al, 2002) and practical knowledge. Prices of agricultural inputs used in the model represent their average retail prices on domestic market from October 2002 (1€ = 7.49 Kn).

RESULTS AND DISCUSSION

Economic efficiency of the investment into the olive grove construction

The sub-model of the olive grove construction is consisted of the following working operations in the first year: bedding of land for the olive trees planting (cleaning, trenching, ameliorative fertilizing and harrowing), planting (planting plan, seedling preparation, digging the planting holes, manure spreading into the planting holes and planting), cultivation (3 times), protection of olives and installing the irrigation system. In the second and third year, sub-model includes working operations of land cultivation (autumn and spring ploughing,

cultivation), fertilizing the soil (basic dressing and additional), protection and pruning.

Considering the chosen technology of the olive grove construction, the model is applicable on agricultural soils of the first and second cadastral class, that is the first class of olive groves (Kovačević, 1986), where a possibility exists of using large mechanization and irrigation.

Total value of the investment into 1 ha of the olive grove is 65,500 kn (Table 1).

Table 1. Investment costs of 1 hectare of olive grove establishment

Type of costs (kn)	1st year	2nd year	3rd year	Total
Material	17,954	1,954	2,450	22,358
Machine labour	7,229	1,979	1,979	11,188
Irrigation system	22,075	–	–	22,075
Fixed costs	4,493	2,693	2,693	8,079
Total	51,751	6,626	7,122	65,500

Major part of the investment costs is placed in the first year of the olive grove construction, taking share of 79% of the total investment costs. Investment costs in the second and the third year of the olive grove construction make 10% and 11% of the total investment costs respectively, referring to the maintaining the olive grove in the sterile stage.

Material costs of the olive grove construction involves costs of the seedlings, manure, mineral fertilizers (NPK, KAN), poles, ropes, plant protection stuffs (pesticides) and water that make 34.13% of the total investment costs.

Working operations with the mechanization during the process of olive grove construction are: trenching, ploughing and cultivation. Machinery costs include services of the mechanized operations during the olive grove construction and make 17.08% of the total investment costs.

The price of the irrigation system "drop-by-drop" is 22,075 Kn and represents the offer of the specialized company dealing with selling and installing the irrigation equipment. The cost of the purchasing and installing of the system participates with 33.7% in the total investment cost structure and represents considerable cost item in the olive grove construction.

Fixed costs are calculated for the farm of the hypothetical size of 2 ha on which 50% of the area is the olive grove, and 50% of area is under other crop production. Fixed costs in the first three years comprise costs of obligatory taxes and contributions on wages and salaries for health and pension insurance for the full time employed farmer and costs of investment maintenance of own small mechanization. In the first year, the fixed costs also

Table 2. Production costs of 1 hectare of olive grove

Type of costs (kn)	4th year	5th year	6th year	7th year	8th, 9th and10[th] year
Material	4,327	5,036	6,107	6,758	7,136
Machine labour	2,662	2,880	3,098	3,252	3,534
Reprocessing costs	547	1,368	2,709	5,472	8,208
Fixed costs	11,685	11,685	11,685	11,685	11,685
Total	19,221	20,969	23,599	27,167	30,564

Table 3. Production dynamics and dynamics of total revenue year by year

Production and total revenue	4th year	5th year	6th year	7th year	8th, 9th and 10th year
Yield; kg/ha	608	1,520	3,010	6,080	9,120
Oil production; kg/ ha[1]	103	258	517	1,034	1,550
Total revenue, kn/ha	4,017	14,926	25,027	45,190	65,314
Oil revenues[2]	3,605	9,030	18,095	36,190	54,250
Incentives revenue[3]	412	5,896	6,932	9,000	11,064

1) average utilisation of oil is 17% (data obtained from Agricultural Co-operative of Marina and olive oil mill of the Institute for Adriatic Crops);

2) Purchasing price of oil 35 kn/kg (Co-operative Alliance of Dalmatia 2002);

3) Incentives: 16 kn per tree, 5 years old and older, 4 kn/l of olive oil sold and delivered to the market (N.N. no. 87/02)

comprise costs of the cost estimate preparation (1,500 Kn) and of chemical analysis of the soil (300 Kn). The cost estimate and the certificate on the chemical soil analysis are obligatory documents that physical person has to enclose to the request for credit approval and for realization the right for olive grove construction subsidy.

Depreciation is not accounted in the model, since the family farm works as a physical person not obliged to pay profit tax and income tax, and therefore not under legal obligation to account the depreciation. The olive grove is not insured because the conditions of insurance offered by insurance companies are not favourable for the family farms in olive growing business.

Own work expressed in working hours is 304 h in the first year, 80 h in the second and 90 in the third year. The sub-model of the olive growing includes working operation of the soil tillage (autumn and spring ploughing, cultivation), soil fertilization (basic dressing and additional fertilizing), plant protection, cutting (winter and summer), harvesting (manual), transport of the fruits and handling operations.

The fourth year is considered as the first year of production, and eighth year as the first year of full fertility. The production costs move from 19,221 Kn in the fourth year to 30,564 in the eighth year (Table 2).

In this period, calculation of the fixed costs, together with previously named, include the annual amount of debt servicing of 8,991 Kn. The own work moves from 257 hours in the first production year to 979 hours in the years of full fertility.

Total (gross) revenue is consist of the revenue from oil production and subsidies (Table 3).

The revenue of oil production is calculated by multiplication presumed oil production and purchase price. The purchase price is long term unchanged settled price of just one part of market participants (co-operatives of olive growers and oil producers), and therefore not subjected to the market mechanisms of supply and demand. Since the majority of olive growers sell the olive oil on a "grey market", on considerably higher prices that in some years reach between 40 and 60 Kn per litre, this purchase price can be considered as the minimum selling price.

Accounted investment and production costs, gross revenue and the data on financial sources were the basis for creating the financial and economic flow of the investment. Financial flow is negative in the fourth (-15,213 Kn) and fifth year (-6,043 Kn). Insolvency in these years is caused by paying debt service liabilities, and therefore the investor needs to ensure additional financial means (21,246 Kn) from other sources. The economic flow is negative in the first four years, and positive in other years.

Estimate of the economic profitability is made by the methods based on the payback period, net present value and internal rate of return on the basis of data from the economic flow.

The payback period is eight years, which means that it is within the determined economic flow and consequently the investment is acceptable for realization.

Net present value is positive (931.85 Kn, under the discount rate of 5%), so according to this method the investment is acceptable for the investor.

Internal rate of return is 5.11% and, since is higher than discount rate, the investment is acceptable by this method as well. The value of the internal rate

of return shows that within the presumed financial sources, the 5% annual interest rate is the maximum level under which the credit could be accepted.

The value of the net present value and of internal rate of return suggest on increased business risk in investing into olive grove predominantly financed by credit means. Under this circumstances, the model is primarily designed for diversified family farms, which are already engaged in olive growing and have intention to invest in its enlargement. Production diversifying and current olive production contribute to a business risk decreasing and overcoming the period of insolvency during the fourth and fifth year.

Economic efficiency of olive production in the period of full fertility

Revenues and outlays in the 8th year of the economic life represented the basis for calculation of economic indicators of olive production in one year of full fertility. The profit of the model in one year of full fertility is 34,751 Kn (Table 4), and the olive grower has to estimate himself if this compensation for his invested work satisfies his expectations.

The economy coefficient of 2.14 points out on satisfying efficiency. The cost price is 19.72 Kn per kg of oil, and the production quantity of 873 kg of olive oil cover all expenses. The economic indicators analysis shows that olive production in full fertility can be economically sustainable under the presumed realized olive yield of 9120 kg/ha, olive production of 1550 kg/ha and purchase price of 35.00 Kn per kg of oil.

It is necessary to stress that obtained results are valid only under the mentioned presumed circumstances and can serve only as orientation for olive growers in the decision making process on investment and management in olive growing and production.

This model provides simulation of different technological solution under different production extent, and their influence on olive production economics. Ability of performing different analysis with different input units represents the key model value. After detailed farm socioeconomic research, research of natural conditions, and economic characterized investments, model can be applied for assaying different factors of olive production economic efficiency in Croatia.

CONCLUSION

Total value of the investment into construction of 1 ha of olive grove is 65,500 Kn. The cost-efficiency estimate shows that investment into construction of 1 ha of olive grove is economically justified. However, the net present value and internal rate of return point out on increased business risk in the investment into

Table 4. Economic results of olive growing, in full yield (8th year)

Description	Value
A. Total revenue, kn	65,314
1. From oil	54,250
2. From incentives	11,064
B. Total costs, kn	30,563
3. Fixed costs	11,685
4. Variable costs	18,878
C. Indicators	
5. Gross margin (A-4), kn	46,436
6. Profit (A-B), kn	34,751
7. Cost-effectiveness (A/B)	2.14
8. Break even price (B/amount of oil), kn/kg	19.72
9. Break even yield (B/selling price /kg), kg	873

olive grove construction predominantly financed by credit means. Under such circumstances, the model is primarily designed for diversified family farms already engaged in olive growing and with intention to invest into its enlargement

The olive grove of the size of 1 ha in one year of full fertility reach the profit of 34,751 Kn, and farmer – olive grower has to estimate himself if this is enough to compensate for his invested work.

Constructed deterministic simulation model represents an useful tool that can serve as support for olive growers in their investment decision making process and in olive production management.

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