STUDY ON THE ECONOMIC EFFICIENCY OF THE MAIN OLEAGINOUS CULTURES IN ROMANIA

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Abstract
This paper aims to determine the economic efficiency that each of the three main oil crops can have, namely the sunflower, soybean and rapeseed in Romania. Starting from the cultivation technologies of these plants it can be determined the main expenses for the cultivation of one hectare. With the help of statistical data on the price of recovery and the average production per hectare, it can be determined the incomes obtained by cultivating each crop taken into consideration, thus, at the end of this paper, it can determined the economic efficiency of cultivating one hectare with one of the three crops studied. These calculations will be performed for two levels of production; thus, two scenarios will be estimated for each crop chosen.

Keywords: *Economic efficiency, oil corps, expenditures, incomes, profitability*
DOI: 10.24818/CAFEE/2019/8/07

Introduction

The present work aims to determine the economic efficiency of oil crops in Romania. This purpose aims to determine the level of expenditure for the three main oil crops in Romania (sunflower, soybean and rapeseed), but also the level of income and implicitly that of profit. Following these assessments of the profitability and economic efficiency of these crops, scenarios can be realized, ideas with which measures can be implemented, strategies for the development of both producers and other stakeholders involved in this agro-food chain. By establishing the level of profitability of these crops the farmers can make forecasts or manage their resources as best as possible in order to achieve a more efficient management.
Oil crops have a growth trend both in terms of the size sown with them, as well as the value of the obtained production. According to the National Institute of Statistics, in 2010, all the three chosen crops were cultivated on an area of about 1.4 million hectares, representing 17.8% of the total area sown, and in 2018, the same crops were sown on an area of 1.8 million hectares, representing 21.4% of the total. As far as the value of the production is concerned, in 2010 there was a value of production of 2.9 billion lei, and in 2017 there was a value of the production of oil crops of 7.1 billion lei. Thus, both from the point of view of the physical dimension and from the point of view of the economic dimension, it can be appreciated that these three oil crops have had a high popularity among agricultural producers.

1. Literature review

According to Surca (2018), *"economic efficiency is most often defined as the close link between the resources allocated to the production process and what results from the process, which leads to the consumption of available resources in a rational way"*.
According to Petre (2018), the incomes obtained from the sunflower culture keep the same gap between the basic and the improved technology, from a relative point of view, registering a difference of 60%, and from an absolute point of view it changes in depending on the recovery price.
Vaselascu (2014) states in the conclusion of his work the fact that *"for greater economic efficiency of this crop, the approval and cultivation of the new varieties with higher productivity and the renewal of the high performing technical equipment capable of reducing the costs of production are necessary"*.
In the work coordinated by Ursu et al. (2017), the efficiency of the three main oil crops in Romania, sunflower, rapeseed and soybean, for the agricultural year 2015-2016, has been specified, where it is specified that the revenue growth rate is higher than the growth rate of the expenses, the ratio being for those three crops being between 1.04-1.09 to 1.
Thus it can be appreciated that in that agricultural year the oil crops were noticeably profitable.
Similarly, Ursu et al (2018) carried out a work on organic farming, and the growth rate of income, for the 2017/2018 agricultural year, is lower than the growth rate of expenditure, so for these crops it can be said that There is a loss, but it should be mentioned that the ecological technologies in Romania are still in their infancy.

2. Experimental section

The economics of energy crops are analysed based on the budgets of income and expenditures. They are presented in Table 2, for sunflower, rape and soybean. The figures are calculated based on the volume and values of the main agricultural works in the field, both manual and mechanized, and on the volume and prices of materials used to perform them. The expenditure varies depending on the technologies applied: with or without irrigation. Thus, two scenarios are considered:
- Scenario 1 – cultivation utilizing the current technology (basic variant)
- Scenario 2 – cultivation utilizing the improved technology (improved variant).

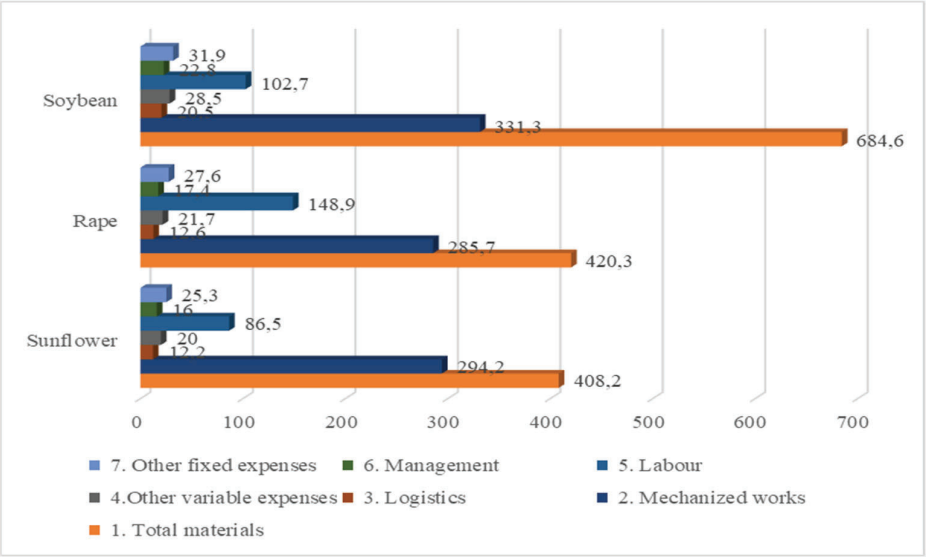
The efforts and effects that characterize these technologies have been quantified economically on the basis of prices and remuneration. The economic efficiency, resulting as a ratio between the different categories of effects obtained and the efforts needed to achieve the technologies, was highlighted by calculating the indicators: production cost, gross margin, profit margin.
The calculations are established for reference year 2017. An overview of energy crops patterns of cultivations is presented in Table 1. The assumptions made for the base case calculations derive from a literature review, from information on energy crops production, i.e. yields, fertilization, chemical control and biomass prices.

Table 1. Overview of energy crops technologies of cultivations

Specification	Sunflower		Rape		Soybean	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Sowing period	April	April	September	September	April	April
Harvesting period	August-September	August-September	July	July	October	October
Yield (kg ha^{-1})	2500	4000	2500	3500	3000	4500
Seeds (kg ha^{-1})	5	5	8	8	90	90
Fertilizers: N:P:K (kg ha^{-1})	135	120	150	120	100	100
Fertilizers: Manure (tons ha^{-1})		15		25	15	30
Mechanized works (hours ha^{-1})	14.1	14.3	13	13.3	13.6	12.6
Labour works (men days ha^{-1})	6.46	6.46	11.26	11.26	6.7	7

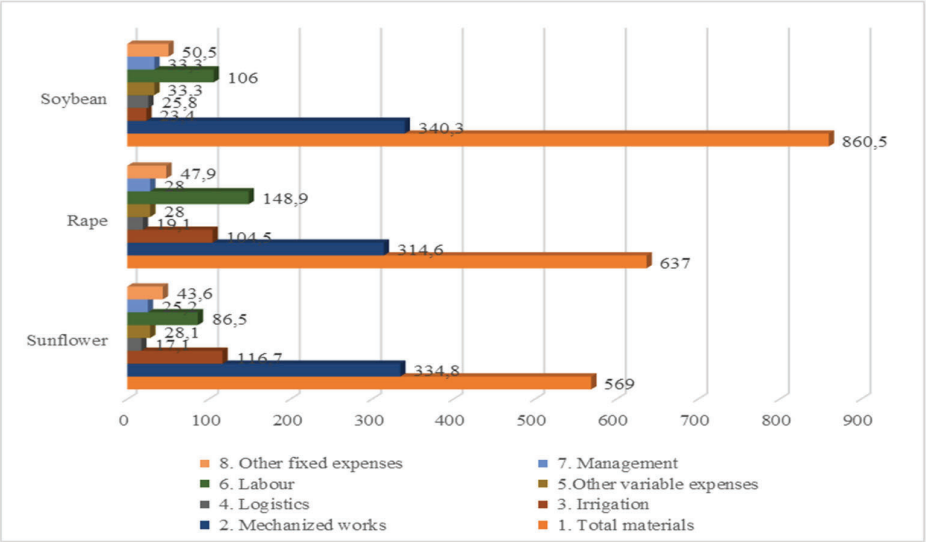
Source: Dincu et al. (1997) and Ursu et al. (2017)

Figure 1. Expenditures of oil crops (euros hectare-1), scenario 1



Source: own calculations based on Dincu et al. (1997) and Ursu et al. (2017)

Figure 2. Expenditures of oil crops (euros hectare-1), scenario 2



Source: own calculations based on Dincu et al. (1997) and Ursu et al. (2017)

Assumptions made in this piece of research refer to sowing and harvesting periods, yields, variable expenses and its components: seeds, fertilizers, pesticides, mechanized works, logistics and fixed expenses with its components: labour and management.

Sowing and harvesting periods differ from one crop to another. Sunflower and soybean are established in spring (April) and harvested in autumn (September and October). Rape is cultivated in September and harvested in July (Dincu and Bran, 1997).

Yields vary depending on natural and weather conditions. The average production of sunflower was 2100 kg ha-1 in 2016 (National Institute of Statistics database), while we consider in our research a yield of 2500 kg ha-1, assuming normal weather conditions and the fact that the technology is respected. Under improved technology (irrigations), sunflower yield increases to 4000 kg ha-1. The average production of rape was 2500 kg ha-1 (National Institute of Statistics database), and we consider the same yield in our research. The average production increases to 3500 kg ha-1 when the crop is irrigated. Statistics (National Institute of Statistics database) show that the average production for soybean is 2500 kg ha-1, while we consider a yield of 3000 kg ha-1, in the system without irrigation, and 4500 kg ha-1, in the system with irrigation. The yields used in calculations are presented in Table 1.

Variable expenses comprise materials, mechanized work, logistics and other expenses. They account for 80% of total expenses in the case of rape cultivation without irrigation, 85% in the case of sunflower and 87% in the case of soybean (Figure 2). In the system with irrigation, the shares of variable costs in total expenses register the same values as in the system without irrigation (Figure 3).

Material expenses refer, mainly, to seeds, fertilizers and pesticides. Seeds consumption is constant from one system to another, buy it varies depending on crop type: 5 kg ha-1 for sunflower, 8 kg ha-1 for rape and 90 kg ha-1 for soybean (Dincu and Bran, 1997). Considering the average price for seeds in 2017, the expenses with seeds are 22.2 euros ha-1 for sunflower, 71.1 euros ha-1 for rape and 175.2 euros ha-1 for soybean (Figure 2 and 3).

Fertilizers used for energy crops may be mineral (N:P:K complex) and natural (manure). The quantities of mineral fertilizers administrated per hectare vary between 100 kg and 150 kg, depending on crop and technology (Table 1). Mineral fertilizers are supplemented with 15-30 tons ha-1 of manure. Considering their average prices, the expenses with fertilizers are 52.5 euros ha-1 for sunflower, 102 euros ha-1 for rape and 299.2 euros ha-1 for soybean, in the system without irrigation, and their values increase in the system with irrigation (Ursu et al. 2017).
Pesticides, including insecticides, fungicides and herbicides are administrated during the vegetation period. Pest, disease and weed control proved to be very essential and is included in the calculations, as follows: 333.4 euros ha-1 for sunflower, 142.7 euros ha-1 for rape and 210.1 euros ha-1 for soybean, in the system without irrigation. They keep almost the same values in the system with irrigation.
Mechanized works refer to field works, ploughing, harrowing, sowing, weeding, harvesting and other works, and they are expressed in hour of mechanization per hectare. These works are undertaken with special agricultural machineries. For energy crops, 12-14 hours of mechanization are needed per year (Table 1). This leads to expenses with mechanized work of 294.2 euros ha-1 for sunflower, 285.7 euros ha-1 for rape and 331.3 euros ha-1 for soybean, in the system without irrigation (Figure 2). They keep almost the same values in the system with irrigation (Figure 3).
Logistics refer to activities of material acquisitions (Istudor, 2011). They vary between 12 to 20 euros ha-1, depending on the crop, in the system without irrigation and increase to 25 euros ha-1 in the system with irrigation, assuming that water is supplied in the second scenario, in addition to other materials (Ursu et al. 2017).
Other variable expenses comprise insurance of arable crops against unforeseeable weather conditions. We assume that transportation is also included in the other variable expenses. The latter vary between 20 to 28 euros ha-1, depending on the crop, in the system without irrigation, and increase to 33 euros ha-1 in the system with irrigation.
Fixed expenses refer to labour and management. They account for almost 20% of total expenses.
Rape needs the highest amount of labour per hectare, in value of 148.9 euros, followed by soybean, 102.7 euros, and sunflower, 86.5 euros, in both systems, with and without irrigation. Management and general expenses register values of 16-22 euros ha-1, in the system without irrigation, and values of 25-33 euros ha-1 in the system with irrigation (Figures 2 and 3).
Other fixed expenses comprise interest on credit and amortization. We assume an average possible interest on credit of 15-20 euros ha-1 for crops in scenario 1 and an average value of amortization of 10 euros ha-1. The value of interest increases to 20-25 euros ha-1 and the value of amortization growths to 23 euros ha-1, in scenario 2.
In addition to expenses presented, in the scenario 2, the consumption with irrigation register values of 116.7 euros ha-1 for sunflower, 104.5 euros ha-1 for rape and lower values for soybean: 23.4 euros ha-1 (Ursu et al. 2017)
Prices used for revenues' calculations are those corresponding to 2017 market conditions: 0.36 euros kg-1 for sunflower, 0.37 euros kg-1 for rape and 0.41 euros kg-1 for soybean (National Institute of Statistics database).
Government incentives. Energy crops which are grown on agricultural land registered under the Single Payment Scheme are eligible for annual subsidies: 163 euros ha-1 for sunflower and rape and 432 euros ha-1 for soy bean.
The current exchange rate used in our calculation is 1 euro = 4.5 lei (National Bank of Romania, 2017).

3. Assessing economic efficiency of energy crops

Economic efficiency can be expressed in different ways, using a complex system of indicators. Among them, ones of the most popular are profit, as difference between revenues and expenses, gross margin, as difference between revenues and variable expenses, cost per unit, and profit margin, as profit share in total revenues. The calculations for profit, gross margin, cost per unit and profit margin for energy crops are presented in Table 2.

Table 2. Economic efficiency of oil crops

Specification	Sunflower		Rape		Soybean	
	Scenario 1	**Scenario 2**	**Scenario 1**	**Scenario 2**	**Scenario 1**	**Scenario 2**
Revenues (euros ha^{-1})	942.2	1511.1	978.3	1383.9	1273.3	1918.9
Expenses (euros ha^{-1})	862.5	1221.0	934.2	1223.6	1222.2	1473.2
Variable expenses (euros ha^{-1})	734.6	1065.6	740.3	998.8	1064.9	1283.3
Profit (euros ha^{-1})	79.7	290.2	44.2	160.2	51.1	445.7
Gross margin (euros ha^{-1})	207.6	445.5	238.1	385.1	208.5	635.6
Profit margin (%)	8.5	19.2	4.5	11.6	4.0	23.2
Cost per unit (euros kg^{-1})	0.35	0.31	0.37	0.35	0.41	0.33

Source: own calculation

For all crops, the profit values are higher in the system of culture with irrigation (scenario 2) compared to the system of culture without irrigation (scenario 1). Among the crops studied, sunflower brings the highest profit per hectare, 79.7 euros, in the system without irrigation, and soybean returns the highest profit per hectare, 445.7 euros, in the system with irrigation. When analyzed in terms of gross margin, among the energy crops, rape returns the highest value of 238.1 euros ha-1, in the system without irrigation, and soybean brings the highest value of gross margin of 635.6 euros ha-1, in the system with irrigation. We may argue, so far, that, in the second scenario, economic efficiency increases compared to the first scenarios, in different proportions, as illustrated in Table 3. We also conclude that, in scenario 2, soybean is the most efficient energy crop cultivated using technology with irrigation, because it returns the highest values of profit and gross margins. The profit is 7.7 times higher in scenario 2 compared to scenario 1 and the gross margin is 2 times higher. The economic efficiency difference is lowest in the case of rape, when the profit is 2.6 times higher in scenario 2 compared to scenario 1 and the gross margin is 0.6 times higher. We may argue that, due to significant differences in profit and gross margin levels, the technology change is justified for soybean.

Conclusions

In order to be able to determine the specific consumptions that are encountered in the case of cultures, the specialized literature was revised in order to determine them and implicitly the costs. After determining the expenses per hectare for the three cultures taken into consideration, it is appreciated that, the smallest expenditures regardless of the technological variant used, are recorded in the sunflower culture (being between 860-1220 euros per hectare), followed by the culture of rapeseed that registers expenses between 930-1230 euros per hectare, and the most expensive crop is that of soybeans with a value of the expenses between 1220 and 1475 euros per hectare.
The incomes obtained were determined by multiplying the value of the valorization with the realized production established by the specialized literature, thus with its help they were determined ice indicator regarding the economic efficiency and the profitability of the crops, such as the profit, the gross margin and the profit margin..
We may conclude that, in the first scenario, sunflower is the most efficient crop in terms of profit, profit margin and cost, and rape is efficient in gross margin. In the second scenario, soybean is the most efficient crop.

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