

## **EQUIVALENT AMOUNTS OF SOYBEANS REQUIRED FOR COVERING THE PRIMARY INPUTS ON SELECTED FAMILY FARMS IN VOJVODINA\***

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### **Abstract**

BOSNJAK, D., V. RODIC and J. KARAPANDZIN, 2015. Equivalent amounts of soybeans required for covering the primary inputs on selected family farms in Vojvodina. *Bulg. J. Agric. Sci.*, 21: 725–729

In recent years, the area devoted to industrial crops in the AP Vojvodina has recorded an increasing trend at the expense of less intensive crops. Therefore, the soybean has especially gained prominence and nowadays accounts for 8% of the total arable land in the province. The future of this trend primarily depends on economic results of soybean production. Since economic results of any production are based on investments on one hand and achieved production value on the other, this paper provides a trend analysis of the basic material investments and the achieved results in the soybean production within the period 2007-2013, as well as their relative interrelation. The purpose is to determine the equivalent amounts of soybeans required for covering the primary inputs and to review the possibilities for further soybean development in the observed area. Since the researches to date have indicated that intermediate goods and fuel constitute up to 2/3 of the total costs within the cost structure of soybean production on family farms in Vojvodina, the analysis was circumscribed to these particular inputs. The obtained results show that the equivalent amounts of soybeans, required for purchasing basic intermediate goods and fuel, varied during the entire observed period, thus directly affecting the economic status of the crop. Covering the costs of basic intermediate goods and fuel per hectare necessitated on average 761 kg of soybeans, which equalled 23% of the average yield. During the most part of the observed period, the so-called external parity grew detrimental to the outputs. It would indubitably result in the producers' loss of interest in soybeans if similar occurrences had not been recorded in other crops as well. The favourable so-called internal parity (between crops) facilitated the competitiveness of soybeans, mainly regarding the selling price in relation to wheat and corn, and even increased the soybean share in the planting structure.

*Key words:* soybean, equivalent amounts, primary inputs, family farms, Vojvodina

### **Introduction**

Family farms are dominant constituents of the agriculture in Serbia and Vojvodina. Notwithstanding a decrease in their number<sup>1</sup>, family farms still possess the largest capacity for agricultural production due to the arable land, which is the most important and stable mean of soil utilisation<sup>2</sup> (Rajić et al., 2007;

Bošnjak and Rodić, 2010a, 2011a). Since the share of other intensive areas (orchards and vineyards) is small, the economic power and development of family farms mostly depend on the utilisation of arable land. The previous researches (Bošnjak and Rodić, 2011a) indicate that, within the structure of arable land utilization, cereals account for 68%, followed by industrial crops (20%), and vegetable and fodder crops (merely 5%).

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\* This research is part of the projects No TR 31022 and OI 179028, financed by the Serbian Ministry of Education, Science and Technological Development

<sup>1</sup> According to the agricultural census in 2012, the number of family farms in Vojvodina is 146 269, which is a decrease of 38% in comparison with the census in 2002 and a decrease of 68% in comparison with the census in 1991.

<sup>2</sup> Family farms account for 73% of the total utilized agricultural area in Vojvodina (according to the agricultural census in 2012). Within the longer period 1955-2009, the share of arable land in the total agricultural land of Vojvodina exceeds 90%, and in the last decade of the period amounts to 94% (Bošnjak and Rodić, 2011a).

In recent years, the area devoted to industrial crops has recorded an increasing trend at the expense of less intensive crops within the structure of arable land utilisation (Bošnjak and Rodić, 2011a; Munćan and Božić, 2013). The soybean has especially gained prominence and nowadays accounts for 8% of the total arable land in Vojvodina, i.e. 1/3 of the area devoted to industrial crops (Bošnjak and Rodić, 2011b; Bošnjak et al., 2013). An increase in the soybean area is a consequence of the heightened interest in soybean production on family farms which devote more than 6% of their arable land to soybeans. Although this marks a significant increase, it is still insufficient regarding potential soil capacities (Bošnjak and Rodić, 2011b; 2012).

Possibilities for any production expansion, as well as soybean production on family farms, primarily depend on the economic motivation of producers. Economic results, whatever the indicators<sup>3</sup>, are based on investments (inputs) on one hand and achieved production value (outputs) on the other. Producers especially pay attention to investments because their monitoring is usually of crucial importance for the success of production, and they can be more greatly and directly influenced than results.

The observed period (2007-2013) was marked by high material investments, which were recorded in other countries as well (Schnitkey, 2013; Duffy, 2014). Unfortunately, this is not a result of an increase in production intensity but it is due to increased purchase prices, which are very volatile (Bošnjak and Rodić, 2010b; Vlahović et al., 2010; Ivanović et al., 2012; Munćan and Božić, 2013). In order to survive on the highly competitive world market, agricultural producers ought to be as efficient as possible, which entails producing high-quality products at lower prices. Business operation efficiency is affected by all inputs, especially by the ones with a significant share in the cost price (Popović, 2007; Munćan et al., 2010; Birovljev et al., 2013). The purpose of this paper is to determine the equivalent amounts of soybeans required for covering the primary inputs in the soybean production on family farms in the AP Vojvodina and to review the possibilities for further soybean development in the observed area.

## Research Methods and Data Sources

The paper displays a trend analysis of the absolute material investments and the achieved results in the period 2007-2013, as well as their relative interrelation. The yield and the production value were used as the result indicators. The analysis was circumscribed to intermediate goods and fuel (Euro diesel) due to the fact that these inputs account for 2/3 of the total costs within the cost structure of soybean production on family farms using their own mechanisation for all

operations except harvesting, which is typical of Vojvodina (Bošnjak and Rodić, 2006; 2010b). The equivalent amounts of input and output, i.e. the amounts of output required for covering the input, were used in the input-output analysis.

Due to significant differences between farms regarding the applied production technology, the research included the selected family farms in the South Bačka District which used the recommended technology<sup>4</sup> and which are nowadays considered the best in soybean production in Serbia.

Comparative and analytical methods were used in the paper in addition to key indicators of descriptive statistics. The research results are conveniently displayed in tables and figures.

The analysed data were obtained by directly interviewing the owners of the selected farms and by reviewing their internal records. The obtained results were compared with the average results achieved on all family farms in Vojvodina (Bošnjak et al., 2014). The value indicators were expressed in Euros. For the conversion of RSD into EUR counter value, the average annual EUR exchange rate of the National Bank of Serbia was used ([www.nbs.rs](http://www.nbs.rs)). Due to a notable seasonality of seed and herbicides use, the February exchange rate was used instead of the average annual rate.

## Results and Discussion

Family farms in the South Bačka District utilise circa 18% of their arable land for soybean production, which vastly exceeds the provincial average. The soybean is an overwhelmingly dominant crop in the district accounting for 3/4 of the area devoted to industrial crops (Bošnjak and Rodić, 2011b, 2012). This should not be surprising since the area is well-recognised for its high soybean yields due to favourable agricultural and ecological conditions (Bošnjak and Rodić, 2010d, 2012).

The analysed family farms possess their own mechanisation (except combine harvesters) and abide by the optimal cultural temporal and operational requirements. The basic cultivation practices on the farms include autumn ploughing and pre-planting preparations in the spring, i.e. ensuring friable and levelled soil structure with two pre-planting cultivations on average. The pre-inoculated seed was used in planting (on average 100 kg per hectare). The soybean planting was usually done in early April depending on weather conditions. Soil fertilisation was a common cultural practice. The observed family farms used on average about 175 kg/ha of NPK 15:15:15 although in recent years a great many producers have started using about 100 kg/ha of MAP-a (12:52:0) due to a decreased content of P in soybean fields. The crop cultivation was mostly focused on weed control. The chemical weed control included the application of various herbicide combinations. Two herbicide treatments were conducted

<sup>3</sup> Profit is the commonest mean of valorising producers' investments on family farms.

<sup>4</sup> The application of this technology would facilitate the satisfactory level of production in Vojvodina as a whole.

on average and the commonest preparation combination was based on imazamox (0.6 l/ha) and thifensulfuron-methyl (4 g/ha). The mechanical control involved two regular inter-row cultivations, whereas manual weeding was recorded in certain years. Depending on the type of power machinery and the distance, size and shape of parcels, 65 l of fuel per hectare is consumed on average.

The performed analysis indicates that the soybean yields on the observed family farms in the period 2007-2013 were under a considerable influence of climatic factors. The results are characterised by a slight decrease at an annual rate of -1.0 % (Table 1), but they are still 38% above (on average 3255 kg/ha) the average achieved on all family farms in Vojvodina (2367 kg/ha).

The selling price of soybean on the analysed family farms is somewhat higher than the average in the province due to the producers' assiduous attention and increased time devoted to sale in recent years. The purchase prices of intermediate goods and fuel in the observed period also indicate a growing trend (Table 2). However, this growing trend does not match an increase in the selling price of soybean therefore the equivalent amounts of soybeans required for covering the primary inputs are reducing (Table 3).

The negative rates of change in the analysed farms exceed the average trend, which indicates the superior management and greater adjustment potential of the farms. In addition to higher yields, special attention is paid to the quality of inputs

**Table 1**  
**Absolute indicators of achieved results in the soybean production on analysed (selected) family farms in the South Bačka District**

Year	Yield, kg/ha	Average annual purchase price, €/kg	Production value, €/ha	Yield	Average annual purchase price	Production value
				Indices		
2007	2 703	0.350	946	-	-	-
2008	3 650	0.295	1 076	135	84	114
2009	3 337	0.266	888	91	90	83
2010	4 261	0.277	1 179	128	104	133
2011	3 346	0.343	1 149	79	124	97
2012	2 530	0.603	1 525	76	176	133
2013	2 956	0.451	1 332	117	75	87
CV, %	16.84	30.2	17.61			
Rate of change, %	-1.00	9.09	7.25			

**Table 2**  
**Average purchase prices of intermediate goods and fuel on the analysed family farms in the South Bačka District**

Year	Prices of intermediate goods and fuel on the analysed family farms				
	Seed	Imazamox (0.6 l/ha)	Thifensulfuron methyl (4 g/ha)	Fertiliser 15:15:15	Euro diesel
	€/kg	€/l	€/8 g	€/kg	€/l
2007	0.50	41.41	N/A	0.28	0.95
2008	0.73	40.12	N/A	0.42	1.11
2009	0.62	31.51	4.35	0.44	0.97
2010	0.64	32.99	4.12	0.37	1.07
2011	0.63	41.73	3.37	0.35	1.30
2012	0.63	46.51	3.72	0.42	1.32
2013	1.03	47.23	3.39	0.58	1.33
Average	0.68	40.22	3.79	0.41	1.15
CV, %	22.52	13.96	10.31	21.54	13.34
Rate of change, %	6.82	3.46	-5.82	7.57	5.97

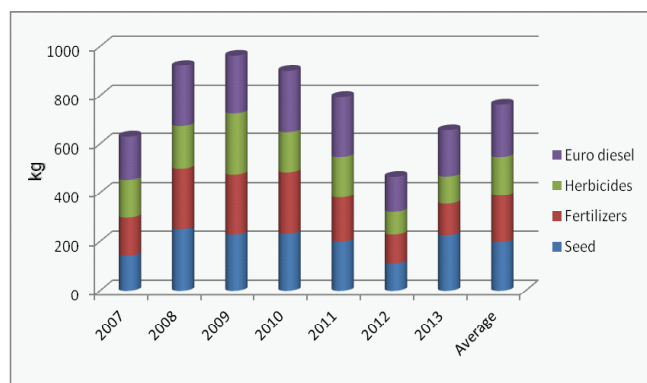
**Table 3**  
**Equivalent amounts of soybeans required for covering the primary inputs**

Year	Equivalent amounts of soybeans, kg				
	Seed	Imazamox (0,6 l/ha)	Thifensulfuron methyl (4 g/ha)	Fertiliser 15:15:15	Euro diesel
2007	1.43	118.30	N/A	0.79	2.71
2008	2.48	136.01	N/A	1.42	3.78
2009	2.33	118.46	16.34	1.64	3.64
2010	2.31	119.10	14.89	1.33	3.87
2011	1.82	121.66	9.81	1.03	3.80
2012	1.05	77.13	6.17	0.70	2.20
2013	2.28	104.73	7.52	1.29	2.94
Average	1.96	113.63	10.95	1.17	3.28
CV, %	25.57	15.07	36.64	27.3	18.66
Rate of change, %	-1.98	-4.88	-21.34	-0.99	-1.98

rather than quantity, which makes their use more efficient. Moreover, the farms can sell products at somewhat higher prices due to the better economic status which enables them to choose more favourable market conditions. Consequently, the more favourable input-output relation is achieved on the analysed farms making both a cause and an effect of their above-average results.

The equivalent amounts of soybeans per unit area required for covering the costs of intermediate goods and fuel were decreasing after 2010 at an annual rate of -4,88% (Figure 1). Such a decrease occurred despite an increase in the costs of certain intermediate goods and fuel due to more intensive increase of selling price of soybeans.

The amounts of soybeans required for covering the costs of certain intermediate goods per unit area varied considerably. It was on average circa 761 kg, which accounted for 23% of the average yield. According to specific types of material investments,

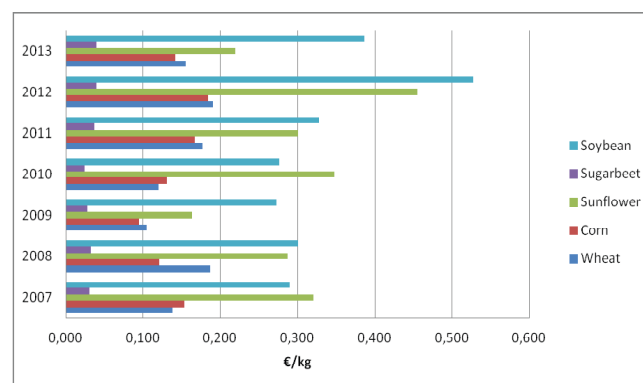


**Fig. 1. Equivalent amounts of soybeans required for covering certain intermediate goods and fuel per unit area**  
 Source: The author's own calculation

on average the largest amounts of soybeans were required for covering the costs of fuel (28%), followed by the costs of seed (26%), inorganic fertilisers (25%) and herbicides (21%).

Prices and their relations are of utmost importance for the producer's selection of crops and the size of areas devoted to them. The researches in the paper have confirmed that higher average purchase prices of soybeans (Figure 2), especially their intensive increase in relation to other field crops and the costs of intermediate goods, directly contribute to the producer's improved economic status and heightened interest in soybean growing, which was the starting point of the research.

The extreme values of purchase prices for most products in 2012 were consequences of a decreased supply (Bošnjak et al., 2013) due to the unprecedented drought, which for instance almost halved the average soybean yield in comparison with the previous season. Similar occurrences were recorded in all other autumn crops.



**Fig. 2. Average annual purchase prices of basic field crops**  
 Source: <http://webrzs.stat.gov.rs/WebSite/public/ReportView.aspx> and the author's calculation

## Conclusion

In the period 2007-2013, the average annual purchase prices of soybeans on the selected family farms in the South Bačka District, Vojvodina, were characterised by a positive trend (the rate of change of 8.00%) in contrast with the achieved yields, which indicated a slightly decreasing trend (the rate of change of -1.0%).

Due to sufficient mechanisation on one hand and the cooperation with extension services on the other, the analysed family farms achieve better results in comparison with the average achieved on all family farms in Vojvodina. The production value per unit area on these farms is higher by 46%, which is a direct consequence of higher yields (circa 38%) and somewhat higher selling price of soybean (1.1%).

The obtained results show that the equivalent amounts of soybeans required for purchasing basic intermediate goods and fuel vary considerably thus directly affecting the economic status of the crop. Since the so-called external parity grew detrimental to the outputs for a certain part of the observed period, it would indubitably result in the producers' loss of interest in soybeans if similar occurrences had not been recorded in other crops as well. Moreover, the favourable so-called internal parity (between crops) facilitated the competitiveness of soybeans, mainly regarding the selling price in relation to wheat and corn, and even increased the soybean share in the planting structure. The future of soybean growing depends on both the input-output relation in soybean production and the input-output relation in the production of other crops.

The achieved results infer the importance of farm management, which significantly influences the input-output relation. Therefore, in order to make a profit in contemporary settings, producers/managers ought to pay attention to production as well as to purchasing inputs and selling outputs. Under volatile circumstances of business operations (present in Serbia for decades), producers ought to possess the comprehensive knowledge of market trends, which they could obtain, first of all through cooperation with extension services.

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