TENDENCIES AND PREDICTION OF INDUSTRIAL PLANT PRODUCTION IN SERBIA

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ABSTRACT

After grain Industrial plants is the second largest group of crops in Vojvodina, and it is cultivated on around 400-450 thousand hectares. The most common is sunflower, followed by soybeans, sugar beets, oilseed rape and the least cultivated one is tobacco. The research analyzes the harvested area, annual production and yield of these most important types of industrial plants in Vojvodina in the period from 2005 to 2019. Descriptive statistics were used for analysis, based on the determined average annual rates of change in the analyzing period, which was base for prediction of production characteristics for the next five years, 2020-24. The average harvested area in analyzed period was: sunflower 173,000 ha, soybeans 160,000 ha, oilseed rape 14,000 ha, sugar beet 60,000 ha and tobacco 3,000 ha. The results of prediction show that will be certain changes in the sowing structure of industrial plants in Vojvodina.

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Introduction

The most important industrial crops in Vojvodina are sugar beet, sunflower, soybean, oilseed rape, potatoes, hemp, cotton, flax, tobacco, hops, chicory, poppy and sorghum. From industrial plants, various products are obtained: sugar, vegetable oils, proteins, vegetable fibers, starch, spices, etc. All of them are used for direct use as human food or for further industrial processing to obtain various industrial products such as: margarine, vegetable fat, confectionery, fruit juices, canned fruit, protein products that replace meat, alcohol, yeast, beer and medicines. Some by-products from the field or from industrial processing are good fodder.

According to the purpose, ie the main product, industrial crops are divided into several groups:

1) Oil plants: sunflower, rapeseed, soybean, poppy and castor bean,
2) Essential oil and medicinal plants,
3) Beautiful (textile plants): cotton, hemp, linen
4) Plants used for the production of sugar, starch and alcohol: sugar beet, potatoes, chicory
5) Other industrial plants, which include only tobacco and hops

The subjects of research in this paper are significant types of industrial crops in Vojvodina(oilseed rape, soybeans, sunflowers, sugar beets and tobacco). Their production characteristics (area, annual production and yields) were analyzed.

The goal of the research is to predict the structure of production in the coming period on the basis of adequate analysis in the past, as well as determining the tendencies of change of given parameters by using quantitative methods and to enable macro economy planning and choosing adequate measures of macro agromanagement which would improve the growth of industrial crops in Vojvodina.

There are a large number of papers in the literature that have dealt with the analysis and prediction of production and value parameters in agriculture. Novković et al. 2006 based on the analysis of time series using the ARIMA model, predicted price parity between wheat and mineral fertilizers. Mutavdžić et al. 2007 predicted the change of price parities between corn and fattening pigs using the same methodology. Mutavdzic et al. 2010 based on the analysis of time series, with the application of the ARIMA model have analyzed and predicted the behavior of price parity between the most important agricultural products. Vukelić, Novković 2009 have analyzed the economic results of milk production on large family farms of dairy cows. Husemann, Novković 2014 have formulated a quantitative model for multinational farm management. Ivanišević et al. 2015 have analyzed changes in the price of tomatoes in Serbia using the method of descriptive analysis. Based on the analysis, the behavior of the price in the following period is predicted. Mutavdzić et al. 2011 have analyzed the tendencies in vegetable

production in Serbia in the period from 2001-2010 and concluded that the total production of vegetables shows a significant increase, primarily due to increased yields. The increase in production ranged from 2% for garlic to 56% for peppers. Tendencies of increased production were present in tomatoes, peas, onions, peppers, beans, carrots and cucumbers. Decreased tendencies were present in potatoes and watermelons, while cabbage had a tendency to stagnate. Novković et al. 2013 have analyzed the tendencies of vegetable production in Vojvodina in the period 2001-2010. The harvested area of the analyzed significant types of vegetables showed a tendency to decrease, with the exception of peas, peppers and garlic. Yields of all analyzed types of vegetables, except tomatoes, as well as total production showed a significant increase in the first decade of the 21st century. Novković, Mutavdžić 2016 analyzed the price of beans in Serbia, using descriptive statistics. Based on the results of the analysis and application of the appropriate ARIMA model behavior of the price of beans in the coming period has been predicted. Mutavdzic et al. 2017 have comparatively analyzed the quarterly changes in price parity between wheat and corn in the Republic of Serbia and the Republic of Srpska in the period 2010-2015. The analysis showed that the prices of grain in the Republic of Srpska are significantly higher than in the Republic of Serbia.

Methods and data sources

The paper applies a descriptive analysis of the production characteristics of significant types of industrial plants in Serbia in the period from 2005 to 2019. Areas, production and yields of sunflower, soybean, oilseed rape, sugar beet and tobacco were analyzed. Based on the results of descriptive statistics, the values of production characteristics for the next five years (2020-24) were predicted. The forecast was made on the basis of extrapolation through the average annual rates of change (r) that were applied to the values of individual phenomena in the last year of the observed period (2019).

Average annual rates of change were calculated according to a formula:

$$G = \left(\frac{Y_n}{Y_1} \right)^{\frac{1}{n-1}}$$

and the average rate of change:

$$r = (G - 1)$$

where

r is the average annual rate of change

G is the average annual index of change

Y_1 is the absolute value of the first member of the time series

Y_n is the value of the last number of the time series

n is the length of the series (number of years).

Precise prediction is achieved by applying the appropriate ARIMA models. But, because , in this case a sufficiently long time series was not available, because in Serbian statistics there is a change in methodology since 2005, in this research is used change rate for prediction.

Data on production characteristics of selected types of industrial crop are taken from the database from the website of the Republic Statistical Office of Serbia.

Results

Analysis and prediction of sunflower production characteristics

Sunflower is the most common industrial plant in Vojvodina. Descriptive statistics of sunflower production parameters are presented in Table 1. The average area under sunflower in Vojvodina was about 173 thousand hectares which was about 90% of the total area under sunflower in the Republic of Serbia. The minimum areas under sunflower were showcased in 2007 and the maximum in 2018. Areas are relatively stable (moderate coefficient of variation) and tend to grow insignificantly, less than one percent per year.

The average yield of sunflower in the analyzed period was about 2.5 t/ha. The coefficient of variation was moderately high. The minimum yield was recorded in 2005 and the maximum in 2019. The yield has a high growth rate of over 4 %.

The average annual production of sunflower was at the level of about 444,000 t. The minimum production was recorded in 2007, and the maximum in 2018. Production shows large variations by years of the analyzed period and shows a tendency to increase at an average annual rate of over 5%.

Table 1. Descriptive analysis of sunflower production characteristics in AP Vojvodina (2015-19) Production parameters

Characteristic	Average Value	Interval of variation		Coefficient of variation(%)	Rate of change(%)
		Minimum	Maximum		
Hectares (ha)	173,290	145,593	219,415	11.01	0.53
Yields (t/ha)	2.54	1.8	3.4	17.53	4.64
Production (t)	444,275	279,179	686,988	26.62	5.18

Source: Own Calculations

The results of prediction of sunflower harvested areas, production and yield for the period from 2020 to 2024 are shown in Table 2. The areas under sunflowers will reach an area of 201,000 ha in 2024, which is 28,000 ha or 16% more than the average of the analyzed period. At the same time, it is 5,274 ha or 2.7% more than the area under sunflower in 2019.

In 2024, sunflower production is projected to exceed 850,000 t, which is 67% more than the average of the analyzed period, or 191,000 t, or almost 29% more than annual production sunflower in 2019.

It is predicted that the sunflower yield in 2024 will exceed 4.2 t/ha, which is 93% more than the average of the analyzed period, ie 800 kg or 24% more than the yield achieved in 2019.

Table 2. Forecast of sunflower harvested area, production and yield in Vojvodina (2020-24)

Year	Area (ha)	Production(t)	Yields (t/ha)
2020	197,059	700,703	3.55
2021	198,109	737,020	3.71
2022	199,165	775,220	3.88
2023	200,227	815,400	4.05
2024	201,294	857,662	4.23

Source: Own Calculations

Analysis and prediction of soybean production characteristics

Soybean was known in today's territory of Vojvodina at the beginning of the 19th centuryIn the last few decades, soybeans have significantly increased their area and production in Serbia, and Vojvodina is the main region for its cultivation.

In the analyzed period, soybean was the second most represented industrial plant and oilseed in Vojvodina. Descriptive statistics of soybean production parameters are given in Table 3. The average area under soybeans was about 160,000 t. This accounted for over 91% of the total soybean area in the Republic of Serbia. The minimum areas under soybean were recorded in 2005 and the maximum in 2019. Areas are slightly more variable than in sunflower (higher coefficient of variation). Areas under soybean tend to grow significantly by about four percent per year.

The average soybean yield was over 2.7 t/ha. The coefficient of variation was moderately high. The minimum yield was recorded in 2012 and the maximum in 2014. The yield recorded an insignificant growth rate, less than one percent.

The average annual production of soybeans was similar to the production of sunflowers and amounted to about 435,000 t thousand tons. Production has been very unstable over the years, both due to area variations and yield variations. The minimum production was recorded in 2012 and the maximum in 2019. The maximum annual was almost 2.5 times higher than the minimum in the analyzed period. Soybean production shows a tendency of high growth at an average annual rate of almost 4.5 %.

Table 3. Descriptive analysis of soybean production characteristics in AP Vojvodina (2015-19)

Production Parameters	Average Value	Interval of variation		Coefficient of variation (%)	Rate of change (%)
		Minimum	Maximum		
Area (ha)	159,852	125,705	213,477	14.43	3.83
Yield (t/ha)	2.71	1.7	3.6	18.15	0.72
Production (t)	435,499	266,801	656,428	25.81	4.45

Source: Own Calculations

The results of prediction of harvested areas, production and yield of soybean for the period from 2020 to 2024 are shown in Table 4. Areas under soybean will reach an area of nearly 258,000 ha in 2024 and exceed the areas under sunflower. In the near future, soybeans will be the most represented fodder plants in Vojvodina. The area under soybean in 2024 will be higher than the average of the analyzed period by over 60%. Compared to the last year, 2019, the area under soybeans in Vojvodina will be higher by over 44,000 ha, or by over 20%.

The prediction shows that in 2024 soybean production will exceed 780,000 t, which is 79% more than the average of the analyzed period, ie to be higher than in 2019 for 125,000 t, or 19%.

It is predicted that soybean yield in 2024 will reach the level of 3.2 t/ha. That is 18% more than the average of the analyzed period. Compared to the achieved soybean yield in the last, 2019 period of the analyzed period, it is more by 100 kg/ha, or 3%.

Table 4. Prediction of soybean harvested areas, production and yield in Vojvodina (2020-24)

Year	Area (ha)	Production(t)	Yields (t/ha)
2020	221,655	685,665	3.12
2021	230,147	716,205	3.14
2022	238,964	748,105	3.16
2023	248,119	781,425	3.18
2024	257,624	816,230	3.20

Source: Own Calculations

Analysis and prediction of oilseed rape production characteristics

Rapeseed is one of the three most important oilseeds in the world, and in some countries where others cannot be grown due to climatic conditions, it is also the most important oilseed plant. This oil plant is becoming especially relevant from the aspect of biofuel production.

In the analyzed period, oilseed rape was the third most important oil plant in Vojvodina. Descriptive statistics of oilseed rape production parameters are shown in Table -5. The average area under oilseed rape was about 16,000 ha (ten times less than soybeans and sunflowers). This accounted for about 83% of the total area under oilseed rape in the Republic of Serbia. The minimum areas under oilseed rape were recorded in 2005, and

the maximum in 2018. Areas under oilseed rape show an extremely high coefficient of variation, which is a consequence of the fact that this crop in Vojvodina began to be produced significantly only in 2007 (12,435ha) Therefore, the rate of change of areas (and annual production) of oilseed rape has been calculated only since 2007, in order to avoid unrealistic extrapolation coefficients. Areas show a tendency of significant growth of over six percent per year.

The average yield of oilseed rape was over 2.6 t/ha (similar to soybeans). The coefficient of variation was moderately high. The minimum yield was recorded in 2010 and the maximum in 2014. The yield has a moderate growth rate of almost three percent

The average annual production of oilseed rape was slightly less than 40,000 t. The variation of production (as well as the area) was very pronounced in the analyzed period, and the reason is that a significant penetration of oilseed rape into the fields of Vojvodina followed only in 2007. The minimum production was recorded in 2005, and the maximum in 2018. The maximum annual production was almost 3.3 times higher than the average production in the analyzed period. Rapeseed production shows a tendency of high growth at an average annual rate of over 8.5 %.

Table 5. Descriptive analysis of oilseed rape production characteristics (2015-19)

Production parameters	Average Value	Interval of variation		Coefficient of variation (%)	Rate of change (%)
		Minimum	Maximum		
Area (ha)	13,999	1,520	41,390	67.15	6.63*
Yield (t/ha)	2,65	2.0	3.3	15.40	2.69
Production (t)	38,815	3,016	126,612	75.06	8.51*

*2007-2019.

Source: Own Calculations

The results of prediction of harvested areas, production and yield of oilseed rape for the period from 2020 to 2024 are shown in Table -6. The area under oilseed rape will reach an area of 37,000 ha in 2024. Despite the high growth rate, the projected area per oilseed rape will not reach the maximum achieved in the analyzed period (41,390 ha, 2018). The area under oilseed rape in 2024 will be higher than the average of the analyzed period by over 160%. Compared to the last year, 2019, the area under oilseed rape in Vojvodina will be higher by over 10,000 ha, ie by almost 38%.

- The - prediction shows that in 2024, rapeseed production will exceed 115,000 t, which is almost three times more than the average of the analyzed period., ie to be higher than the production in 2019 by 125,000 t, or 19%. The projected production for 2024 is higher than the production of oilseed rape realized in 2019 by almost 39,000 t, or 50%. At the same time, the projected production in 2024 is 11,000 t, or 9% less than the maximum realized production of oilseed rape in the analyzed period in Vojvodina.

It is predicted that the oilseed rape yield in 2024 will reach the level of 3.2 t/ha. This is 20% more than the average of the analyzed period, ie it is 550 kg/ha. In comparison with the last analyzed year, the predicted yield of oilseed rape for 2024 is higher by 300 kg/ha, or 10%.

Table 6. Prediction of oilseed rape harvested areas, production and yield in Vojvodina (2020-24)

Year	Area (ha)	Production(t)	Yields (t/ha)
2020	28,655	83,223	3.12
2021	30,554	90,305	3.14
2022	32,580	97,990	3.16
2023	34,740	106,329	3.18
2024	37,044	115,378	3.20

Source: Own Calculations

Analysis and prediction of sugar beet production characteristics

Sugar beet is the second most important plant for sugar production in the world. It participates with about 40% in world sugar production, while the remaining 60% of sugar is made from sugar cane. Of the total world production of sugar from sugar beet, about 85% falls on Europe.

Descriptive statistics of sugar beet production parameters are shown in Table7. According to the presence on the surfaces, sugar beet is on the third place among industrial plants in Vojvodina. The average area under sugar beet was 60,000 ha. This accounted for as much as 96% of the total area under sugar beet in the Republic of Serbia. The minimum areas under sugar beet were recorded in 2015, and the maximum in 2006. Areas under sugar beet are characterized by a high coefficient of variation. Areas show a tendency to fall significantly at an average annual rate of over three percent.

The average yield of sugar beet was over 48 t/ha. The coefficient of variation was moderately high. The minimum yield was recorded in 2012, and the maximum in 2014. The maximum yield was over 50% higher than the minimum. The yield recorded a weak growth rate, less than one percent.

The average annual production of sugar beet was slightly less than 3,000,000 t. The variation of production (as well as the area) in the analyzed period was very pronounced, as evidenced by the high coefficient of variation. The minimum production of sugar beet was recorded in 2015 and the maximum in 2010. The maximum annual production was 63% higher than the minimum, ie 23% higher than the average production in the analyzed period. Sugar beet production shows a tendency of moderate decline at an average annual rate of almost 2.5 %.

Table 7. Descriptive analysis of sugar beet production characteristics in AP Vojvodina (2015-19)

Production Parameters	Average Value	Interval of variation		Coefficient of variation (%)	Rate of Change (%)
		Minimum	Maximum		
Area (ha)	60,055	41,937	83,292	19.81	-3.23
Yield (t/ha)	48.28	36.00	54.90	10.29	0.79
Production (t)	2, 871. 686	2, 178. 487	3, 542. 521	16.30	-2.47

Source: Own Calculations

The results of prediction of harvested areas, production and yield of sugar beet for the period from 2020 to 2024 are shown in Table 8. The area under sugar beet in 2024 in Vojvodina will fall to the level of about 36,000 ha. That surface

is at the level of 60% of the average areas in the analyzed period. Areas under sugar beet will be less than the average by over 24 thousand acres, ie less by more than 6,000 ha than the minimum harvested area in the period 2005-2019. Practically, it is predicted that in 2024 the harvested area under oilseed rape will be larger than the harvested area under sugar beet.

The prediction shows that in 2024, sugar beet production will fall to the level of about 2 million tons. That is 1,500,000 t less than the maximum production, 800,000 t less than the average and 270,000 t less than in 2019. Expressed in relative terms, sugar beet production will fall to the level of 57% of maximum production, 70% to the level of average production, ie to the level of 88% of production in 2019.

It is predicted that the sugar beet yield in 2024 will reach the level of 56.5 t/ha. This is 3% (1.6 t) more than the maximum yield, 17% (8.2 t) more than the average yield, or 4% (2.2 t) more than the realized yield in 2019.

Table 8. Prediction of sugar beet harvested areas, production and yield in Vojvodina (2020-24)

Year	Area (ha)	Production(t)	Yields (t/ha)
2020	40,890	2,239,368	54.73
2021	39,568	2,184,145	55.16
2022	38,288	2,130,284	55.59
2023	37,051	2,077,751	56.02
2024	35,853	2,026,514	56.46

Source: Own Calculations

Analysis and prediction of tobacco production characteristics

Tobacco, unlike other analyzed industrial plants, is not used for food or energy. After drying, sorting and fermentation, tobacco leaves serve as the basic raw material for making cigarettes, cigars, pipe tobacco and other means of enjoyment. Of the chemical constituents of the leaves, the most important is nicotine, a highly toxic alcaide, which, when smoked or otherwise introduced into the human body, in moderation, has a calming or irritating effect, depending on the condition of the nervous system. Other leaf ingredients also contribute to the enjoyment of tobacco: ether ointment, resins and others. Growing and processing tobacco achieves great economic benefits. Varieties of the following types of tobacco are widespread in our country: oriental aromatic cigarette, semi-oriental, American large-leaved and Central European large-leaved. About half of the total production is exported in processed form. Tobacco cultivation intensively uses land that is less suitable for other plants, mainly due to the relief and lower fertility.

Descriptive statistics of tobacco production parameters are shown in Table9. The average area under tobacco in the observed period in Vojvodina was about 3,500 ha . This accounted for about 57% of the total harvested area under tobacco in the Republic of Serbia. The minimum areas under tobacco were recorded in 2010 and the maximum in 2007. Areas under tobacco are characterized by a moderate coefficient of variation. The maximum areas were over 50% larger than the minimum. Areas under tobacco show a tendency of slight growth at an average annual rate above one percent.

The average yield of tobacco was over 1.5 t/ha. The coefficient of variation was moderately high. The minimum yield was recorded in 2019 and the maximums in 2010 and 2014. The maximum yield was over 58% higher than the minimum. Tobacco yields recorded a moderate rate of decline, of about two percent. The yield in Vojvodina was about 100 kg higher than the national average.

The average annual production of tobacco was about 5,300 t. The variation of production in the analyzed period was similar to the variation of the area, of moderate intensity. The minimum tobacco production was in 2018, and the maximum in 2014, when one of the maximum tobacco yields was achieved.

The maximum annual production was about 44% higher than the minimum, ie 22% higher than the average production in the analyzed period. In the total tobacco production in Serbia, Vojvodina participated on average with about 62%. Tobacco production shows a tendency to fall slightly, at an average annual rate of less than one percent.

Table 9. Descriptive analysis of tobacco production characteristics in AP Vojvodina (2015-19)

Production Parameters	Average Value	Interval of variation		Coefficient of variation (%)	Rate of change (%)
		Minimum	Maximum		
Area (ha)	3,453	2,858	4,325	10.19	1.15
Yield (t/ha)	1.55	1.2	1.9	12.87	-2.02
Production (t)	5,345	4,546	6,538	10.82	-0.65

Source: Own Calculations

The results of prediction of harvested areas, production and yield of tobacco for the period from 2020 to 2024 are shown in Table 10. In 2024, the area under tobacco in Vojvodina will reach the level of four thousand acres. This area is 550 ha, or 16% larger than the average area in the analyzed period. The projected areas under tobacco in 2024 will be higher by 220 ha, or 5.5% of those achieved in 2019. The projected areas will not reach the maximum areas achieved in the analyzed period. It will be 320 ha less.

The prediction shows that in the forecast period, the annual tobacco production will fall by 120 t, and in 2024 it will fall to the level of about 4,500 t. This is about 850 t less than the average, or 2,500 t of maximum tobacco production in the analyzed period. Compared to 2019, tobacco production in 2024 will be lower by 670 t. Expressed in relative terms, tobacco production will fall to the level of 60% of maximum production, 75% to the level of average production, and to the level of 86% of production in 2019.

It is predicted that the tobacco yield in 2024 will symbolically fall by 40 kg/ha compared to 2019. That is, it is less by 390 kg/ha than the average, or 740 kg/ha less than the maximum yield of tobacco achieved in Vojvodina in the analyzed period. Expressed in relative indicators, the yield of tobacco will fall to the level of 61% of the maximum yield, 75% to the level of the average yield, ie to the level of 97% of the yield achieved in 2019.

Table 10. Prediction of tobacco harvested areas, production and yield in Vojvodina (2020-24)

Year	Area (ha)	Production(t)	Yields (t/ha)
2020	3,826	4,642	1.19
2021	3,870	4,612	1.18
2022	3,915	4,582	1.18
2023	3,959	4,552	1.17
2024	4,005	4,523	1.16

Source: Own Calculations

Discussion and Conclusion

Based on the above research results, the following conclusions can be drawn:

- Sunflower has a tendency to increase production, area and yield. The average area was 173.000 ha, the average yield was 2.5 t/ha, and the average production was 444,000 t. In 2024, an area of 201,000 t, a yield of 4.2 t/ha as well as production in the amount of 858,000 t is projected. The upward trend is present in all three production parameters (area, production and yield).

- Soybeans show a tendency to increase area, production and yield. The average area was 160,000 ha, the average yield was 2.7 t/ha, and the average production was 435,00 t. It is predicted that in 2024 the area under soybeans will be 258,000 ha, the yield at the level of 3.2 t/ha, the production will amount to 816,000 t. This means that in 2024 the expected area under soybeans will be larger than the area under sunflowers, ie that soya will be the densest industrial crop in Vojvodina.

- Oilseed rape has a very high tendency to increase area, production and yield. The average area was 14,000 ha the average yield was 2.6 t/ha, and the average production was 39.000 t. In 2024, the projected area under oilseed rape will be 37,000 ha, production 115,000 t and a yield of 3.2 t/ha. This means that in 2024 the area of oilseed rape will be larger than the area under sugar beet, and it will take third place in terms of harvested areas of industrial plants in Vojvodina.

- Sugar beet shows a tendency to decrease areas and production, but also an increase in yield. The average area was 60,000 ha, the average yield was 48.3 t/ha, and the average annual production was at the level of 2.9 million tons. In 2024, it is projected to reduce the area to the level of 36,000 ha, yield at the level of 56.5 t/ha and production of about 2,000,000 t. This means that in 2024, the projected area of sugar beet will be smaller by the area under oilseed rape, ie in the fourth place in terms of representation of industrial plants in Vojvodina.

- Tobacco shows a tendency to decrease yields and production, while an increase in areas is noticeable. The average area for the period from 2005 to 2019 is 3,450 ha, the yield was 1.6 t/ha, and the production was 5,300 t. In the last year of forecasting (2024), it is predicted that the area will increase to 4,000 ha, the yield will fall to the level of 1 t/ha, and for production it will fall to the level of 4,500 t.

Conflict of interests

The authors declare no conflict of interest.

References

1. Husemann, Ch., Novkovic,N. (2014): Farm management information systems: A case study of on a German multifunctional farm, *Economics of Agriculture 61 (2)*, (269-552), 441-453, DOI: 10.5937/ekoPolj1402441H.

2. Ivanišević, A., Mutavdžić, B., Novković, N., Vukelić, N. (2015): Analysis and prediction of tomato price in Serbia, *Economics of Agriculture 62 (4)* (899-1178), 951-961, DOI: 10.5937/ekoPolj1504951I.
3. Mihajlović Š., Vukelić N., Novković, N., Mutavdžić B. (2018): Vegetable Prices In Serbia – Tendencies And Forecasting, *Economics of Agriculture 65 (2)* (330-660), 485-498.
4. Mutavdžić B., Novković, N., Nikolić-Đorić E., Radojević, V. (2007): Analysis and prediction of pig price parity – maize, *Conteporary Agriculture 1-2*, 177-181. [*in Serbian*: Мутавџић Б., Новковић, Н., Николић-Ђорић Е., Радојевић, В. (2007): Анализа и предвиђање паритета цена свиње - кукуруз].
5. Mutavdžić, B., Novković, N., Ivanišević, D. (2010): Prediction of parity of prices of basic agricultural products, AroSym, Faculty of Agriculture East Sarajevo, Jahorina, 176-182. [*in Serbian*: Мутавџић, Б., Новковић, Н., Иванишевић, Д. (2010): Предвиђање паритета цена основних ратарских производа].
6. Mutavdžić Beba, Novković N., Ivanišević D. (2011): Tendencies of vegetable development in Serbia, *Agroznanje 12 (1)*, University of Banja Luka, Faculty of Agriculture, 23-31. [*in Serbian*: Мутавџић Беба, Новковић Н., Иванишевић Д. (2011): Тенденције развоја повртарства у Србији].
7. Mutavdžić B., Drinić Lj., Novaković , T., Vaško Ž., Novković, N. (2017): The Comparative Analysis of Grain Prices in Serbia and Republic of Srpska, Book of Abstracts, 6th International Symposium on Agricultural Sciences, University of Banja Luka, February 27 – March 2, 2017 Banja Luka, Bosnia and Herzegovina, ISBN 978-99938-93-41-7, 54.
8. Novković, N., Janković, N., Mutavdžić B. (2006): Analysis and forecasting of parity prices of wheat prices / mineral fertilizers, *Agroekonomika (34-35)* Faculty of Agriculture, 65-71. [*in Serbian*: Новковић, Н., Јанковић, Н., Мутавџић Б. (2006): Анализа и предвиђање кретања паритета цена пшеница/минерално ђубриво].
9. Novković, N., Mutavdžić B., Ilin, Ž., Ivanišević, D. (2013): Potato Production Forecasting, *Agroznanje 14 (3)*; Banja Luka, 345-355.
10. Novković, N., Mutavdžić B. (2016): Analysis and forecasting of bean prices in Serbia, Proceedings of papers: Policy and Economics for Sustainable Agricultural and Rural Development, AAEM 10th International Conference, 12-14 May, Ohrid, Association of Agricultural Economists of the Republic of Macedonia, 195-203.
11. Vukelić N., Novković, N. (2009): Economic results of milk production on large households, *Economics of Agriculture, 56,* 99-110 [*in Serbian*: Вукелић Н., Новковић, Н. (2009), Економски резултати производње млека на крупним сељачким газдинствима].