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PRODUCTION OF SUNFLOWER AND RAPESEED IN METROPOLITAN AREA BELGRADE-NOVI SAD AS SUPPORT TO BEEKEEPING DEVELOPMENT[1]

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Summary

In the paper authors analyzed production of sunflower and rapeseed in the metropolitan area Belgrade-Novi Sad, considering the fact that these are economically very important melifferous plants. Authors presented the relation that exists between crops production and beekeeping, from the aspect of ecological and economic benefits. Special emphasis is put on the connection of ecological crop farming and beekeeping.

In Vojvodina, sunflower is third the most important crop, after wheat and maize. Sunflower is one of the most important melliferous plants in our country, whose yield depends on pollination successfulness by bees, which activity depends on amount and quality of nectar related to plant variety, sowing time, applied agro-techniques, soil moisture and rainfall, during flowering. In compare to sunflower, which is entirely cross-pollinating plant, rapeseed is partially cross-pollinating plant, which can be pollinated by bees. In both cases, benefits from this mutual "bee-plant" activity, have both crop farmers and beekeepers. Each year, ecological production is increasing. Ecological crop farming combined with beekeeping practice contributes to biodiversity preservation together with favorable social and economic effects. Successful ecological crop production considers, among other, using of domestic varieties adapted to local environmental conditions and therefore more resistant to pests and diseases. On the other hand, one of the basic demands of ecological honey production is pasture on crops non-treated with artificial chemicals or on areas under natural vegetation. Also, in ecological production it is not allowed to use genetically modified crops and honey, which contains pollen gathered from genetically modified plants, must be properly labeled. Certificate about ecological production is a guarantee of product's safety for people and environment. Considering that demand for ecological products increases each year, which is the result of increased fear of

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consumers regarding non-quality food with possible negative health consequences, possible strategy of agricultural producers could be their reorientation on ecological farming methods.

For the analysis of sunflower and rapeseed production in metropolitan area Belgrade-Novi Sad, authors used official data of Statistical Office of the Republic of Serbia for period 2001-2012. Data are used for obtaining descriptive statistical parameters interpreted in the paper. Metropolitan area Belgrade-Novi Sad includes 11 municipalities: Beočin, City of Belgrade, Inđija, Irig, City of Novi Sad, Pančevo, Pećinci, Ruma, Smederevo, Sremski Karlovci and Stara Pazova. Besides official statistics data, authors used relevant domestic and foreign scientific and professional literature presented by: papers published in scientific journals and proceedings, books and monographs, reports at national and international level.

According to available statistical data, metropolitan area has 537.449 ha of agricultural land, which is 10,5% of agricultural land in the Republic of Serbia. In observed area, industrial crops are produced on 13% of arable land. One third of areas under industrial crops are covered by sunflower, while rapeseed is produced on 2,3% of these areas, in average. By comparing variation coefficients it can be concluded that variability of areas under rapeseed is 5,7 times larger than variability of areas under sunflower. In average, the most significant areas under sunflower are in Belgrade, than Ruma and Pančevo, while the most significant areas under rapeseed are in Pančevo, Belgrade and Inđija. However, in 2012, the largest areas under sunflower were in Pančevo, Pećinci and Belgrade, while rapeseed was presented the most in Belgrade and Ruma. Areas under sunflower have negative average rate of change (-1,52%), while areas under rapeseed have positive rate of change (16,72%). Total sunflower production in metropolitan area varies from 29.618 - 51.456 tons annually, with average rate of change -0,08%, which can be explained by decreasing of areas under this crop during the last years. Variability of total production is 14,56%. However, variability of rapeseed production is about 6 times higher, but with positive average rate of change (18,34%). Average rapeseed production at the territory of metropolitan is 3.500 tons annually. Average sunflower yields in metropolitan area are about 2 t/ha and are lower than the republic average which is 2,2 t/ha. Authors determined positive rate of change of yield per hectare 0,28%, with variation coefficient 8,30%. Rapeseed yield is about 1,3 t/ha, which is also lower than republic average, with high variation coefficient and positive average rate of change (9,9%) in observed period. To improve and support beekeeping development it is important to stimulate production of sunflower and rapeseed and especially, development of ecological methods of crop farming for the purpose of production of products with added value, more attractive for export at foreign markets.

Key words: *crops, beekeeping, production of ecological products*

JEL classification: *Q 10*

1. Introduction

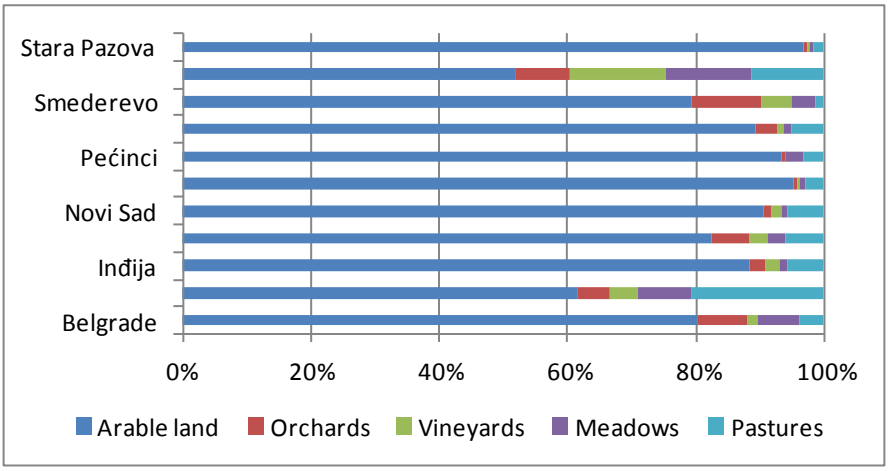
The most important oil plants in Serbia are sunflower and soya bean, but in the last few years, more areas are under third oil plant - rapeseed (Marinković et al., 2011).

Sunflower is very profitable crop due to its small demands for moisture and nutrients, which this plant efficiently takes and uses from deeper soil layers. Sunflower is resistant to drought and do not require large agro technical investments, and therefore it is very suitable for our agricultural production conditions. Pollination of sunflower by bees is very important in production of this crop. Free (1964) indicates that sunflower yield can be increased by putting of bee colonies in the sunflower crop and that, on the other hand, sunflower yield is decreased if bee colonies are mowed away from the crop. Similar research results have Nderitu et al. (2005). Importance of sunflower as melliferous plant originates from the time period of flowering, large number of flowers per area unit and from significant potential of flowers to create nectar. This pasture can be significant in honey production where honey characteristics of sunflower hybrid and weather conditions have the key role (Ion et al., 2007).

Production of rapeseed in these areas has long tradition, but areas under this crop are being increased only in recent years. Production of biodiesel in the world caused greater interest for rapeseed because its seed has larger oil content. Some studies suggest that there is a possibility of higher rapeseed yield after being visited by honey bees, although this plant is being considered as self-pollinated plant (Nedić et al., 2013, Sabbahi et al., 2005, Sidddique Munawar et al., 2009;). On the other hand, there are results that showed that using of bees as pollinators did not or slightly influenced at increase of rapeseed yield (Koltowski, 2005). Different results can be explained by using of different crop varieties, by conducting of studies in different ecological conditions as well due to differences in research methodology. Analyzing the honey potential of rapeseed, Nedić et al. (2013) concluded that this crop is reliable but insufficient pasture for bees in Serbia.

2. State of sunflower and rapeseed production at Metropolitan area Belgrade-Novi Sad

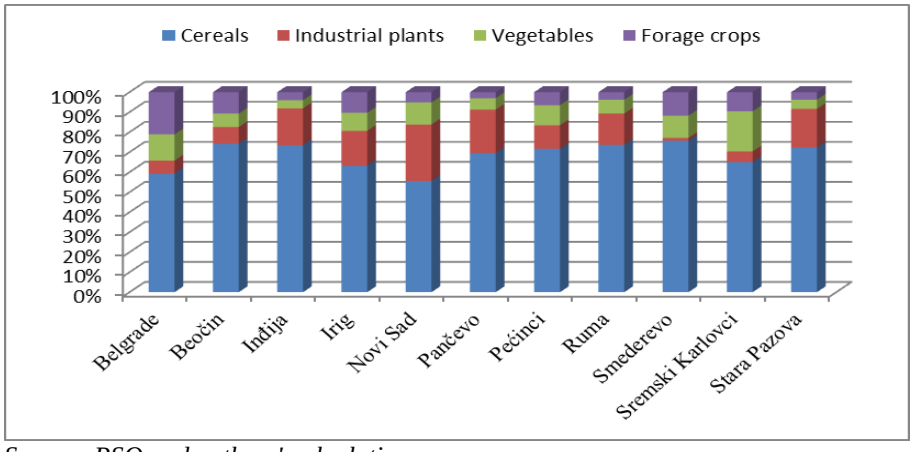
For this research, Metropolitan area includes eleven municipalities: Beočin, The City of Belgrade, Inđija, Irig, The City of Novi Sad, Pančevo, Pećinci, Ruma, Smederevo, Sremski Karlovci and Stara Pazova. According to the official statistical data, this area has 537.449 ha of agricultural land, which is 10,5% of total agricultural land of Republic of Serbia. Structure of agricultural land utilization in Metropolitan area is presented by Graph 1.



Source: RSO and authors' calculation

Graph 1 Structure of agricultural land utilization in municipalities of Metropolitan area

The largest part of agricultural area in Metropolitan is presented by arable land, about 84,7%, and the least areas are under vineyards, about1,4%, which indicates at existence of extensive production. At arable areas dominate production of wheat, industrial and forage crops, and the least areas are under vegetables (Graph 2).



Source: RSO and authors' calculation

Graph 2 Structure of production at arable land in Metropolitan area Belgrade-Novi Sad

Industrial plants are produced at 13% of arable land. One third of areas under industrial plants is covered with sunflower, while rapeseed is produced at 2,3%, in average.

The most significant areas under sunflower are in Pančevo, Beočin and Pećinci, which in average have 43%, 13% and 9% of total areas under sunflower in Metropolitan area. Values of variation interval as well as values of variation coefficient indicate the instability of sunflower market, which impacts the presence of areas under this crop. The least areas under sunflower are recorded in 2007, and the largest in 2003 (Table no. 1.). For period 2001-2012, it is determined negative annual rate of change of areas under sunflower, which does not have to seriously impact the production volume.

Unlike sunflower, rapeseed production is increasing, as evidenced by the rate of change of 16.72% annually. Area under rapeseed in Metropolitan area is still quite low and for the analyzed period is averagely 1,600 ha. The most important areas are located in Belgrade, Pančevo and Ruma. High value of the coefficient of variation indicates high degree of dispersion of values in the series.

Table 1: Areas under sunflower and rapeseed in Metropolitan area Belgrade-Novi Sad, ha

Crop	Average	Variation interval		CV (%)	Change rate (%)
		min	max		
Sunflower	18.192	13.931	22.403	12,46	-1,52
Rapeseed	1.600	162	3.126	71,64	16,72

Source: RSO and authors' calculation

Sunflower yield of 2 t/ha is somewhat lower in compare to perennial republic average. Wide variation interval indicates significant impact of weather but also inadequate agro-techniques application. Average yields in analyzed time series are practically unchanged considering the value of rate of change (Table 2).

In production of rapeseed there are low yields of only 1,3 t/ha where lack of rainfalls or irrigation, as well as losses caused by state of agricultural mechanization are the main reasons. Wide variation interval as well as high values of variation coefficients prove the significant impact of weather conditions on the production of this crop and unadjusted production technology for this crop. So, the least yields are recorded in 2002, while in later period there is an increase of yield considering larger experience of producers.

Table 2: Yield of sunflower and rapeseed at the territory of Metropolitan area Beograde-Novi Sad, kg/ha

Crop	Average	Variation interval		CV (%)	Change rate (%)
		min	max		
Sunflower	1978,90	1764,23	2259,63	8,30	0,28
Rapeseed	1279,16	571,65	2510,22	50,40	9,9

Source: RSO and authors' calculation

Sunflower production in Metropolitan area at annual level is averagely 33.500 tons (Table 3). Considering mild decrease of areas under this crop and constant average yields, it is expected mild decrease of the total production. Dry year 2012 had negative consequences on field crops production, and therefore on sunflower so, the smallest yields refer to analyzed time series in 2012 and the highest in 2008.

Table 3: Total production of sunflower and rapeseed at the territory of Metropolitan area Belgrade-Novi Sad, tons

Crop	Average	Variation interval		CV (%)	Change rate (%)
		min	max		
Sunflower	33.520	29.618	51.456	14,56	-0,08
Rapeseed	2.578	277	7.633	98,53	18,34

Source: RSO and authors' calculation

Total rapeseed production in Metropolitan area varies from year to year, which is indicated by very high value of variation coefficient. The smallest production volume is achieved in 2005. For analyzed series there is production growth of 18,34% of average rate.

3. Pollination of crops and ecological production of honey

Bees are the most important pollinator of sunflower, where in our climatic conditions optimal relative air moisture for sunflower pollination is between 40-50% and optimal air temperature is from 20-28°C.The largest impact on nectar quantity and bee visits of this plant species have weather conditions and agro-techniques, as well as type of hybrid, where the impact of external factors is probably more important than genotype (Miklič et al, 2002). The sunflower yield largely depends on genotype and according to the same author, the largest nectar content among sunflower hybrids in our country, has hybrid NS-H-111, which is the most attractive for bees. Sunflower usually blossoms at the end of June, that is

at the beginning of July, and it is intensive pasture because daily honey impact can be to 10kg, and from one hectare of sunflower one can collect to 250 kg of honey (Umeljić, 2010). To guarantee pollination, recommendation is to put 2 bee hives at one hectare of sunflower. This cooperation of crop farming and beekeeping practice gives double benefit - sunflower production is more secure, and considering that sunflower is honey plant, one can get significant honey yield. Rapeseed, for beekeepers more important winter rapeseed which blossoms in April, is a good nectar and pollen plant whose flowering can last to one month. Rapeseed honey has specific light yellow color and crystallizes fast. Bee society develops fast at rapeseed, they build comb regularly and larger amounts of wax can be obtained (Umeljić, 2010). In our country, areas under rapeseed are increased and it can be expected to be planted at area of 50.000-60.000 ha. Rapeseed is grown because of the seed which contains 40-48% of oil and 18-25% of proteins. From one hectare of rapeseed in full flowering, bees can collect to 80 kg of honey, and on plots with good agro-techniques to 195 kg (Marinković, 2009).

Decrease of honey production at sunflower pasture as well as decrease of seed yield, is recorded during the last years in our country, which matches with general decrease of agro-techniques level, mainly with decrease or total lack of fertilization (Miklič et al, 2000). On the one hand, lack of sufficient fertilization negatively impact sunflower yield and thus beekeeping pasture and honey yield, and on the other hand it should be stated that many studies shown that there is negative relation between excessive application of certain agricultural chemicals, bees health and safety of bee products. Agricultural chemicals, in application in conventional crop farming can be accumulated not only in bee products but also in the body of bees. For example, some insecticides as in the case of neonicotinoids, is contributed to be one of the causes of drastic decrease of bees population in the world[4]. Pesticides such as imidacloprid, from the group of neonicotinoids, toxically impact the bees and it is being used in protection of sunflower. Sub lethal doses of this pesticide negatively impact on bees' life length, formation of brood, development of hypopharingeal gland and bee queen activity. Imidacloprid can impact at the immune system of bees and appearance of diseases due to chronic intoxication with small doses. In countries with long tradition of honey production, such as France, known for production of sunflower honey, many pesticides used in conventional agriculture, are banned due to activity of strong beekeeping lobby.[5] According to Bogdanov (2006), sources of contamination of bee products may trough water, air and plants reach bees but also by activity of the beekeeper. Besides pesticides, large part of contaminants is from inadequate beekeeping

[4] http://www.efsa.europa.eu/en/press/news/130116.htm?utm_source=homepage&utm_medium=infocus&utm_campaign=beehealth

[5] The World of organic Agriculture, Statistics and Emerging Trends 2011

practice and beekeeper can by adjusting its work, decrease concentration of some unwanted substances in the honey.

Large risk for organic beekeeping in the world represents also production of genetically modified organisms, such as genetically modified rapeseed, whose pollen and nectar bees collect and which is in expansion in the world. Bees do not distinguish genetically modified crops from conventional or organic crops and pollen collected from genetically modified crops can be detected in honey. Export of honey from Canada to Europe, due to large areas under genetically modified rapeseed, was drastically decreased. In Europe, upper limit for content of genetically modified components in food is 0,9% and all products with higher content of genetically modified components in the food must be clearly labeled. However, considering that honey has from 0,1 to 0,5% of pollen, its labeling is not required. From this reason, organic food producers in Europe, insist that maximal level of genetically modified components in food be 0,1%[6]. In Serbia, and many countries of European Union, there is no commercial production of genetically modified rapeseed (Gordana Zdjelar, 2011).

In protection of bees and their products, for beekeepers the most important is limitation or exclusion of various contamination sources of bee products. One of ways to achieve this is to start with organic beekeeping methods which require that all wax and swarms used in beekeeping must be organically produced, that is synthetic pesticides are banned, feeding of bees must be only with organic honey or organic sugar and for varroa one must use only organic acids, etheric oils and biotechnical methods. One of the basic conditions that must be achieved in organic beekeeping is quality pasture at natural vegetation or organic crops. Pasture at genetically modified organisms is not allowed. In organic crop farming it should be fully respect crops rotation, which is mean measure against diseases and pests, use of organic fertilizers in optimal amounts, use organic seed and right choice of hybrids. In EU countries, beekeepers understood the significance of organic beekeeping and so beekeepers who are potential entrepreneurs realize that it is profitable to be "green", that is to protect the environmental quality, maintenance of essential ecological processes and life support systems, the preservation of genetic diversity of the bee and the capitalization and protection of pollination (Anca A. POPA et al., 2012). In European Union there is a strong demand for organic honey and beekeepers that can give such honey get better price for their product. Industrialized countries cannot produce enough quantities of organic honey and there is a great demand for import, especially of unifloral honey[7]. Production of organic honey in less developed countries is interesting from

[6] The World of organic Agriculture, Statistics and Emerging Trends 2011

[7] Apimondia - first world conference on organic beekeeping (2010), *Organic beekeeping, the way to pure natural honey*, p.5

financial point, because beekeepers can get higher price for organic honey in compare to conventionally produced honey. On the other hand, domestic producers in less developed countries are not ready to pay higher price for organic honey. Estimation of organic honey market in Europe in about 6.500t/year that is 2% of total honey market, of which about 2.500t belongs to Germany (POCOL Bianca Cristina and Anca Aurora POPA, 2011). In world there is about 0.9% of agricultural areas under organic agricultural production, where in some countries percent of total areas under organic production is over 10% (Willer H. and Kilcher L, 2011). Organic production of apiary products in Serbia is still small, in compare to total amount of beekeeping products. In 2012, total number of organic hives was 4.394 with 2.610 hives in conversion period[8]. Arable land used for organic production is on area of over 11.000 ha, mainly under orchards while crop farming is on 41% of organic arable areas, which is small in compare to natural resources in our country.

4. Conclusion

Availability of agricultural land and favorable climatic conditions for sunflower and rapeseed production at the territory of Metropolitan area is not used. Having in mind that industrial crops are grown at about 13% of arable land there are certainly potentials for expansion of these areas which would have positive effect on honey production. Considering that organic products have increasing importance at European market, larger support and effort should be given to involve potential producers to plant more areas under organic crops which would positively impact development of organic beekeeping in Serbia.

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[8] *Organska poljoprivreda u Srbiji, 2013*

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