

# Analysis of the Structure of Fruit and Vegetable Production in the County of Dubrovnik-Neretva in the Context of the Self-Sufficiency Ratio in the Period 2016 to 2018

---

Domagoj Ivan ŽERAVICA (✉)  
Mara MARIĆ

## Summary

---

Due to favourable agrometeorological and pedological conditions, Dubrovnik-Neretva County (DNC) has all the prerequisites for diversified agricultural production in line with the requirements of the county market. The available statistical data analysis (2015-2020) indicated the diversification and self-sufficiency of agricultural production in terms of meeting the requirements of average consumption of DNC (2016 to 2018). The structure of the production (2016-2018) indicates insufficient product diversification; on average 75% of agricultural production of DNC in the observed period refers to mandarins and watermelons. The structure of fruit production by groups shows that the production of southern fruits (citrus fruits)<sup>1</sup> statistically satisfies consumption in the county, while the greatest lack of required quantities is indicated in the category of stone fruit (32.14%), apples (32.14%) and pears (5.76%). The analysis of the structure of vegetable production shows that fruiting and leafy vegetables are produced in satisfactory quantities, while the greatest shortage is indicated in potatoes (12.29%) and root vegetables (13.65%). With a proper analysis of market needs, improvement and diversification of agricultural production in agricultural areas of the county, it is possible to increase the level of self-sufficiency in the cultivation of fruits and vegetables.

## Key words

---

agriculture, self-sustainability, demand, Dubrovnik-Neretva

University of Dubrovnik, Department for Mediterranean Plants, Marka Marojica 4, 20 000 Dubrovnik, Croatia

✉ Corresponding author: domagoj-ivan.zeravica@unidu.hr

Received: December 18, 2020 | Accepted: September 25, 2021

---

<sup>1</sup> The category is taken from CBS consumption data, although citrus fruits are not the only species that can be called a southern fruit. Due to the need to find out the food demands of Dubrovnik-Neretva County, production data are distributed according to consumption categories taken over from CBoS, further explained in footnotes 2, 7 and 8

## Introduction

Agriculture is one of the key elements for the realisation of the idea of self-sustainability of a society. Agricultural production directly affects many demographic and economic indicators, which makes it one of the key factors in economic development (Meijerink and Roza, 2007; Timmer, 2002).

Thanks to climatic and pedological diversity, year-round vegetable and diverse fruit crop production is possible in the Republic of Croatia (Matotan, 2008; Čmelik, 2010). Despite favourable production conditions, tradition and traffic position, the production of fruits and vegetables in the Republic of Croatia is insufficiently developed, which is confirmed by the level of self-sufficiency in fruit (40.2%) and vegetable crops (61.9%) (Ministry of Agriculture, 2019). Among the most prominent inadequacies of agricultural production in the Republic of Croatia are the degree of production profitability due to fragmented plots, insufficient use of technology in production, an insufficient number of producer organisations and joint market entry, as well as an insufficient number of cold stores and capacities for storage and processing of fruit and vegetables (Ministry of Agriculture, 2019). In addition to the above, additional problems of agricultural production in the county of Dubrovnik-Neretva are related to its indented topography, as well as small and fragmented production locations, which is the reason for low productivity. In terms of development, Dubrovnik-Neretva strives to become one of the highest-ranking tourist destinations (Tourism Development Strategy for DNC for the Period 2012 to 2022, 2013). Quality agricultural products, such as an indigenous assortment and organically grown fruit and vegetables, keep pace with planned tourism development targets. The need for a strong market positioning of the agricultural sector in Dubrovnik-Neretva does not only arise from the tourism market potential. The coronavirus COVID-19 pandemic has shown all the fragility of the domestic agricultural sector and a generally low level of self-sufficiency in the entire food sector. The aim of this paper is to present the existing agricultural production situation in the fruit and vegetable sector of the county on the basis of available statistical data and to place these data in correlation with the market.

### *Agricultural Production of DNC*

DNC has a rich history of growing agricultural crops. Grapevines have been present in Dalmatia for more than 2 millennia, olives have been grown in the area of Dubrovnik since the 9<sup>th</sup> century BC, and the written works of numerous travel writers testify to the cultivation of different types of citrus in the gardens of Dubrovnik region since the Middle Ages (Bakarić, 2002; Bakarić, 2007; Andabaka et al., 2016; Marić and Paladin, 2017). Today, olives, grapevines and mandarins are the most common cultivated crops<sup>1</sup> in the county (Table 1, Table 2), which proves their continuous presence in this area for many centuries.

Agriculture production in the Mediterranean area has advantages compared to other climate regions of the Republic of Croatia. Higher winter temperatures and number of sunny days a year enable the production of vegetables in greenhouse without heating or only with reheating, which results in lower

<sup>1</sup> The paper does not deal with data on vines and olives, since they are used for the production of wine and olive oil; this paper deals with the production of fresh fruit and vegetables intended for consumption.

production costs and more competitive pricing (Grgić et al., 2016), while in fruit production vegetation begins earlier, fruits ripen earlier, thus achieving the highest possible selling price; in addition to southern and subtropical, continental fruit species can also be grown (Miljković, 1991; Miljković, 1996). Despite the favourable agro-ecological conditions for agricultural production of Dubrovnik-Neretva (Šegota and Filipčić, 2003; Ires ekologija, 2016; Husnjak, 2016), current production of fruits and vegetables does not fully meet the needs of the county (Table 3). Although in the past production areas were distributed along the entire territory of Dubrovnik-Neretva (Konavosko polje, Stonsko polje, Šipansko polje, etc.), today the only significant production area is the Neretva valley, but also with insufficiently utilised capacity. Despite the current situation, the county is looking at agricultural development, through which it could successfully meet the needs of its own market.

### Research Methods and Data Sources

In order to present the state of agriculture in Dubrovnik-Neretva, available data provided by the Agency for Payments in Agriculture, Fisheries and Rural Development (hereinafter PAAFRD) for the period 2015 to 2020, as well as the data from the Croatian Bureau of Statistics (hereinafter CBoS), were used.<sup>2</sup> The data presented in this paper represent a comparison of agricultural production of fruit and vegetables with average consumption, calculated on the basis of available statistical data referring to Dubrovnik-Neretva. In addition, for the purposes of the research, a low-structured, targeted interview with the most important purchasers in the county was conducted with the aim of determining the quantities of fruits and vegetables purchased from Dubrovnik-Neretva and to ascertain if demands were being met.

### Quantitative indicators of agricultural production in DNC

The current state of agricultural production in the county, in the fruit and vegetable sector is shown, listing agricultural areas and the major fruit and vegetable crops.

According to ARKOD, the total area of agricultural land used in Dubrovnik-Neretva in 2019 was 9,625.85 ha (Table 1), while the total area of agricultural land in the county was 124,545.40 ha (Husnjak, 2016), which shows that only about 7% of agricultural land is used.

<sup>2</sup> Data on the agricultural areas of represented fruit and vegetable crops for 2016, 2017 and 2018 are multiplied by the average yields for the stated years (CBoS data), where the specified product represents the average yield of these crops in a given period according to available statistical data. The product of data on average consumption of fruits and vegetables in the Republic of Croatia (Survey on average household consumption in 2017; CBoS, 2019) and the population of the county according to the 2011 census was taken as data on average consumption per capita in the county of Dubrovnik-Neretva, i.e. demand for fruit and vegetables in the specified period of time. Data on agricultural production areas of watermelons and melons are presented as fruits because they are listed in the PAAFRD data, while the professional literature states that they belong to the family *Cucurbitaceae* (Tikvenjače) (Lešić et al., 2004), which is also accepted in this paper. In the survey on average household food consumption of the Croatian Bureau of Statistics, fruits and vegetables were divided into subcategories with corresponding consumption per capita. Same categories were used when measuring the satisfaction of the needs (Table 4), in order to arrive at the average consumption in Neretva-Dubrovnik.

**Table 1.** Areas of ARKOD in Dubrovnik-Neretva in 2016, 2017, 2018 and 2019 – type of use of agricultural land (source: PAAFRD 2017b, PAAFRD 2018b, PAAFRD 2019b, PAAFRD 2020b)

Agricultural area	31.12.2016	31.12.2017	31.12.2018	31.12.2019
	Hectares (ha)	Hectares (ha)	Hectares (ha)	Hectares (ha)
Arable land	1,024.53	1,030.52	1,025.39	1,033.35
A greenhouse on arable land	51.44	49.60	49.14	50.52
Meadow	152.38	145.81	156.69	168.07
Karst pasture	1,039.23	975.32	946.53	863.68
Vineyards	2,355.65	2,241.36	2,143.34	2,124.37
Uprooted vineyards	30.77	39.28	43.36	41.64
Olive grove	2,661.89	2,698.64	2,584.67	2,575.62
Orchard	2,299.42	2,307.80	2,263.34	2,376.07
Nursery	18.58	23.78	28.96	23.95
Mixed permanent crops	212.03	229.42	248.84	267.24
Other types of land use	197.05	165.28	34.33	26.90
Temporarily unmaintained plot			60.60	74.44
<b>Total</b>	<b>10,042.99</b>	<b>9,906.81</b>	<b>9,585.19</b>	<b>9,625.85</b>

The largest part of the area refers to olive groves (26.76%), orchards (24.68%) and vineyards (22.07%). In the observed period (2016-2019) there is a noticeable decrease in the area of vineyards (9.82%) and olive groves (3.24%), and an increase in orchards (3.23%) and mixed permanent crops (20.66%).

The analysis of data on orchard areas in 2019 shows that the share of these areas (2,376.07 ha) in the Republic of Croatia (36,754.76 ha) is 6.46% (PAAFRD, 2020b). Orchards in Dubrovnik-Neretva cover 9,147 ARKOD plots, i.e. the average orchard size (ARKOD plot) in the county is 0.26 ha, which is less than the average of the Republic of Croatia (0.42 ha) and the counties of Zadar (0.38 ha) and Istria (0.28 ha). In Dubrovnik-Neretva, the Neretva valley stands out with an average orchard size (plot) of 0.27 ha, while in the rest of the county (except for the Neretva valley) the average is 0.21 ha. The data provided shows the fragmentation of fruit production in Dubrovnik-Neretva, which is particularly pronounced in parts of the county outside the Neretva.

In addition to fragmentation, such plots are often inaccessible, which further complicates agricultural production. Also, data on greenhouse areas confirm that the Neretva valley is the region that is the most favourable for agriculture in Dubrovnik-Neretva. According to available data on agricultural land in 2019, Dubrovnik-Neretva ranks fifth in the Republic of Croatia with 50.52 ha of greenhouse areas and occupies 7.68% of 658.13 ha of the total area. Of these 50.52 ha, 93.94% (47.46 ha) are located in the Neretva Valley (PAAFRD, 2020b).

Organic agriculture in Dubrovnik-Neretva has great prospects, primarily due to the county's extensive tourism market. The value

of consumption of organic products correlates with the level of economic development (according to the CboS, 2019., in 2017 GDP per capita amounted to HRK 93,810, the average of the Republic of Croatia was HRK 74,846), and most visitors come from economically developed countries where there is a tradition of higher organic food consumption (Grgić, 2019). There has been a growing trend for areas to adopt organic farming and the number of producers of organic products has increased, both in the world and in the Republic of Croatia (Šugar and Brčić, 2019). Great potential for further development of organic agriculture is represented by traditional types of fruit and vegetable, of which 150 have been recorded in Dalmatia (Ozimec et al., 2015). Given the economy of Dubrovnik-Neretva and its high GDP per capita, the popularity and lack of such products on the market, a stronger orientation towards organic production is economically justified. The strategic documents envisage the development of the county, especially the administrative area of the city of Dubrovnik and its surroundings as one of the highest-ranking tourist destinations that strives for a higher price range. Therefore, such a market is ideal for these types of agricultural products, especially in terms of more expensive agro-technical processing due to the topographic characteristics of the county, insufficient transport links and significantly smaller production areas than the Croatian average.

According to the data available (PAAFRD) on organic production in Dubrovnik-Neretva, the reported plots amounted to 678.04 ha in 2018, 751.35 ha in 2019 and 1093.5 ha in 2020. In the period stated (2018 - 2020), organic agriculture areas increased by 415.46 ha (61.27%), and the greatest growth, an increase of 342.15 ha, refers to the year 2020. The share of organic production of the county in the overall ecological production of the Republic of

Croatia (108,178.80 ha) is 1% (PAAFRD, 2020a), which indicates a lack of agro-ecological production areas in relation to the rest of the territory of the Republic of Croatia. The largest share of agro-ecological production of Dubrovnik-Neretva in 2020 related to karst pastures (69.18%), olive groves (12.09%), vineyards (8.19%) and fruit species (8.79%), while the Neretva Valley (49.82%) led in such areas (PAAFRD, 2020a).

### ***Characteristics of Fruit Crop Cultivation in the County of Dubrovnik-Neretva***

Cultivated fruit species in Dubrovnik-Neretva were analysed for the period 2015 using available data on agricultural land (Table 2). Data on olive groves and vineyards were excluded from the analysis because they were analysed separately (Table 1).

According to data for 2020 (Table 2), the most represented fruit species in Dubrovnik-Neretva were mandarins (1,498.54 ha; 67.17% of the total area of all fruit species), watermelons (190.48 ha; 8.54%), mixed orchards (174.76 ha; 7.83%) and figs (102.31%, 4.59%). The total area being used for fruit crops in the observed period increased by 509.95 ha, or 22.86%. The largest share of the increase in individual crops is related to mandarins, figs and watermelons. The reason for the increase of these crops lies in the fact that these crops are less demanding and do not require a great deal of human labour. Alluvial soils in river valleys are suitable for growing watermelons without irrigation; in the case of planting on a mulch of polyethylene film, weeds are eliminated and human labour is reduced to shallow digging and fertilisation (Lešić et al., 2004), which is why watermelons are extremely common in the Neretva Valley (the share of the Dubrovnik-Neretva watermelon production in the total production of the Republic of Croatia was 28.63%).

In the observed five-year period, it can be seen that citrus fruit is the fruit species showing the greatest increase in agricultural production areas, where mandarin stands out as the most represented fruit species in the county. Due to the cultivation of 98.83 % of total production in the Republic of Croatia (PAAFRD, 2020a), the Neretva Valley is the centre of Croatia's mandarin orange production. The valley has excellent conditions for intensive cultivation of high-quality Unshiu mandarins whose great advantage is their cold resistance - they can withstand shorter periods of cold weather up to -10 °C (Kaleb, 2014).

The largest reductions in agricultural land in the period 2015-2020 were recorded in stone fruit trees: plums (7.92 ha), cherries (2.70 ha) and peaches (1.93 ha). The example of peaches and nectarines shows the changing trends in production. In the observed five-year period (2015-2020), the area being used for these crops was reduced by 1.45 ha. A comparison of 2020 (30.70 ha) with the 2003 Agricultural Census (77.27 ha) shows a significant decrease by a total of 46.57 ha. In the period before 1991, peaches and nectarines were one of the most common species in the Konavle orchards, where they were grown because of favourable climatic conditions and the probability of product distribution in a number of nearby cities in the region (Dubrovnik, Herceg Novi, Kotor and Trebinje). Due to the unfavourable traffic links around Konavle in the years after the war, product placement was difficult, so these orchards were neglected, which explains today's reduction in agricultural area. On top of all that,

the average lifespan of a peach and nectarine tree is 20 to 30 years (Kantoci, 2006), which is why a large part of commercial plantations have completed their production cycle. Today, peach and nectarine plantations are among the most represented crops in the county of Zadar (Bačić, 2015), which is not surprising given the development of agriculture in the area, the existence of storage capacity and good traffic connections with the rest of Croatia. A significant difference in areas planted with peaches and nectarines will also be noticeable in the new Census of Agriculture 2020, given that the last census in 2003 was undertaken before the drastic reductions in these fruit species. According to the 2003 Agricultural Census, in the Republic of Croatia, the County of Dubrovnik-Neretva was in second place after the County of Istria in terms of the share of intensive plantations (48.1%), where, apart from peaches and nectarines, mandarins (1053.42 ha), plums (54.28 ha) and apples (27.94 ha) predominated (Čmelik, 2010; CBoS, 2003). A comparison of the above data with the data from 2020 shows an increase in areas planted with mandarins (445.12 ha) and apples (14.13 ha), while the areas planted with plums have decreased (32.52 ha).

### ***Characteristics of Vegetable Crop Cultivation***

The analysis of the structure of vegetable crops in the period 2015-2020 shows that in 2020, 25.40 ha more vegetable crops were planted than in 2015, which is an increase of 7.43%.

The most common individual vegetable crops in 2020 are cabbage (58.44 ha; 15.92% of the total share), potatoes (25.71 ha; 7.00%) and pumpkins and squash (13.22 ha, 3.60%). Due to production in different climatic regions, cabbage is present on the Croatian market throughout the year. Unlike the continental and hill-mountain area, in the area where the Mediterranean climate offers early springs and late autumns, winter cabbage is grown (Lešić et al., 2004), which is why cabbage produced in Dubrovnik-Neretva offers the opportunity of marketing at times when there is no production of this agricultural culture in other cultivated areas of the Republic of Croatia. This indicates the importance of the production of this crop in Dubrovnik-Neretva, which is further confirmed by the growth trend of such agricultural areas in the observed period (Table 3).

Mixed vegetable plantations occupied 209.12 ha (56.97%) of the total vegetable production area. Considering the number of agricultural holdings in the county (4,580 in 2019) and the high share of such plantations, it can be concluded that this production is mostly intended to meet the needs of producers, and less market production.

The groups most represented by cultivated vegetable crops are leafy (76.16 ha) and fruit vegetables (39.71 ha), while root vegetables are grown on 14.78 ha. All three groups of vegetable crops recorded a decline in agricultural production areas in the observed period (2015-2020).

Potatoes are one of the most represented crops in the county but, at the same time, vegetable crops recorded almost a 50% reduction in agricultural areas during the observed period (Table 3). There is an obvious decline in the surface area of this crop in 2016 and 2018 (Table 3) after two unfavourable production years, due to which some producers stopped cultivating this crop. Owing to the ban on the use of the active substance chlorpropham

**Table 2.** Cultivated fruit species in the county of Dubrovnik-Neretva from 2015 to 2020 (source: PAAFRD 2015, PAAFRD 2016, PAAFRD 2017a, PAAFRD 2018a, PAAFRD 2019a, PAAFRD 2020a)

Agricultural culture	Surface (ha)						Share 2020		Difference 15 / 20
	2015	2016	2017	2018	2019	2020	%	%	ha
Mandarin - <i>Citrus reticulata</i> B.	1,226.37	1,333.33	1,437.96	1,412.94	1,456.30	1,498.54	67.17	22.19	272.17
Watermelon <sup>1</sup> - <i>Citrullus lanatus</i>	138.01	151.46	155.31	179.69	193.96	190.48	8.54	38.02	52.47
Orchards	87.96	89.00	113.05	115.53	122.43	174.76	7.83	98.68	86.80
Fig - <i>Ficus carica</i>	77.85	83.78	89.37	93.27	149.91	102.31	4.59	31.42	24.46
Apple - <i>Malus x domestica</i> Borkh.	38.07	42.02	46.92	46.56	44.49	42.07	1.89	10.51	4,00
Pomegranat - <i>Punica granatum</i> L.	24.69	29.65	34.58	34.87	34.62	40.95	1.84	65.86	16.26
Peach - <i>Prunus persica</i> L.	29.72	30.83	29.00	26.27	28.15	27.79	1.25	-6.49	-1.93
Melon <sup>2</sup> - <i>Cucumis melo</i> L.	18.20	28.32	28.80	28.03	23.26	27.21	1.22	49.51	9.01
Strawberry - <i>Fragaria x ananassa</i> Duch	11.92	15.89	26.82	23.88	27.49	26.40	1.18	121.48	14.48
Plum - <i>Prunus domestica</i> L.	29.68	27.80	27.52	23.53	24.62	21.76	0.98	-26.68	-7.92
Lemon - <i>Citrus limon</i> L.	5.05	7.90	10.53	9.82	16.15	20.17	0.90	299.41	15.12
Hazel - <i>Corylus avellana</i> L.	0.30	0.86	0.84	0.93	0.97	11.25	0.50	3,650.00	10.95
Apricot - <i>Prunus armeniaca</i> L.	7.05	11.30	7.83	8.01	7.80	10.12	0.45	43.55	3.07
Orange - <i>Citrus sinensis</i>	3.37	6.48	9.82	4.88	7.59	8.85	0.40	162.61	5.48
Cherry - <i>Prunus avium</i> L.	10.83	11.85	10.64	6.98	7.71	8.13	0.36	-24.93	-2.70
Pear - <i>Pyrus communis</i> L.	2.75	3.02	2.82	3.16	3.49	3.90	0.17	41.82	1.15
Walnut - <i>Juglans regia</i> L.	0.75	2.18	2.30	3.65	4.07	2.94	0.13	292.00	2.19
Nectarine - <i>Prunus persica</i> L.	2.43	1.71	2.34	2.20	1.48	2.91	0.13	19.75	0.48
Aronia - <i>Aronia arbutifolia</i> L.	1.58	1.00	2.12	2.72	2.75	2.83	0.13	79.11	1.25
Cherry - <i>Prunus cerasus</i> L.	0.28	0.68	0.63	0.65	0.93	2.20	0.10	685.71	1.92
Almond - <i>Prunus dulcis</i>	1.00	1.05	0.80	0.57	1.85	1.80	0.08	80.00	0.80
Carob - <i>Ceratonia siliqua</i> L.	0.81	1.21	0.34	0.49	1.10	1.05	0.05	29.63	0.24
Kiwifruit - <i>Actinidia chinensis</i> Planch.	0.43	0.75	1.09	0.97	1.09	1.04	0.05	141.86	0.61
Blackberry - <i>Rubus fruticosus</i> L.	0.64	0.56	0.56	0.42	0.58	0.38	0.02	-40.63	-0.26
Kumquat - <i>Citrus japonica</i>		0.31	0.46	0.23	0.22	0.27	0.01		0.27
Grapefruit - <i>Citrus paradisi</i>						0.20	0.01		0.20
Raspberry - <i>Rubus idaeus</i> L.	0.66	0.07	0.18	1.03	0.07	0.15	0.01	-77.27	-0.51
Cranberry - <i>Vaccinium vitisidaea</i> L.					0.13				
Feijoa - <i>Acca sellowiana</i>						0.14	0.01		0.14
Jujube - <i>Ziziphus jujuba</i> Mill.						0.13	0.01		0.13
Goji berry - <i>Lycium barbarum</i> L.						0.10			0.10
Quince - <i>Cydonia oblonga</i> Mill.	0.48	0.11	0.12	0.14	0.31			-100.00	-0.48
<b>TOTAL</b>	<b>1,720.88</b>	<b>1,883.12</b>	<b>2,042.75</b>	<b>2,031.42</b>	<b>2,246.73</b>	<b>2,230.83</b>	<b>100.00</b>		<b>509.95</b>

<sup>1</sup> Watermelon (*Citrullus lanatus*) belongs to the squash family (*Cucurbitaceae*), i.e. vegetables (Lešić et al., 2004), but in the PAAFRD data it is included under fruit species

<sup>2</sup> Melon (*Cucumis melo*) belongs to the squash family (*Cucurbitaceae*), i.e. vegetables (Lešić et al., 2004), but in the PAAFRD data it is included under fruit species

**Table 3.** Cultivated vegetables species in the county of Dubrovnik-Neretva from 2015 to 2020 (source: PAAFRD 2015, PAAFRD 2016, PAAFRD 2017a, PAAFRD 2018a, PAAFRD 2019a, PAAFRD 2020a)

Agricultural culture	Surface (ha)						Share 2020	Change 15 /20	
	2015	2016	2017	2018	2019	2020	%	%	ha
Vegetable crops	139.00	179.32	210,48	203.03	213.93	209.12	56.97	50.45	70.12
Cabbage - <i>Brassica oleracea</i> L.	53.50	59.54	49.86	61.91	63.78	58.44	15.92	9.23	4.94
Potato - <i>Solanum tuberosum</i> L.	50.50	36.34	37.78	24.59	27.32	25.71	7.00	-49.09	-24.79
Pumpkin, squash - <i>Cucurbita pepo</i> , <i>Lagenaria vulgaris</i>	14.41	10.84	16.50	11.86	8.76	13.22	3.60	-8.26	-1.19
Beetroot - <i>Beta vulgaris</i> L. <i>subsp. vulgaris</i>	12.95	11.18	12.23	7.60	6.04	7.71	2.10	-40.46	-5.24
Tomato - <i>Solanum lycopersicum</i> L.	15.92	8.45	8.82	10.47	5.78	7.09	1.93	-55.46	-8.83
Chard - <i>Beta vulgaris</i>	5.28	3.01	6.19	5.00	5.62	5.64	1.54	6.82	0.36
Garlic - <i>Allium sativum</i>	1.62	0.85	2.53	5.10	5.94	5.41	1.47	233.95	3.79
Pepper - <i>Capsicum annuum</i> L.	4.01	4.77	4.72	3.63	4.42	4.37	1.19	8.98	0.36
Carrot - <i>Daucus carota</i> L.	13.86	11.74	10.84	4.43	1.29	3.67	1.00	-73.52	-10.19
Salad - <i>Lactuca sativa</i>	5.49	4.22	5.76	5.15	5.04	3.58	0.98	-34.79	-1.91
Onion - <i>Allium cepa</i>	1.63	2.91	1.07	2.14	4.75	3.29	0.90	101.84	1.66
Cucumbers and gherkins - <i>Cucumis sativus</i> L.	1.71	2.51	2.99	2.94	2.99	3.00	0.82	75.44	1.29
Kale - <i>Brassica oleracea</i> var. <i>sabauda</i>	5.77	3.81	5.51	4.71	8.10	2.20	0.60	-61.87	-3.57
Cauliflower - <i>Brassica oleracea</i> var. <i>botrytis</i>	3.92	2.80	2.68	2.47	9.14	2.02	0.55	-48.47	-1.90
Bean - <i>Phaseolus vulgaris</i>	1.70	2.11	0.78	2.02	2.10	2.00	0.54	17.65	0.30
Parsley - <i>Petroselinum crispum</i>	2.13	6.56	1.68	0.73	1.66	1.87	0.51	-12.21	-0.26
Spinach - <i>Spinacia oleracea</i> L.		0.20	2.12	0.46	0.49	1.40	0.38		1.40
Eggplant - <i>Solanum melongena</i>	3.65	0.72	0.20	0.96	0.11	1.33	0.36	-63.56	-2.32
Celery - <i>Apium graveolens</i> L.	0.14			0.25	0.25	1.32	0.36	842.86	1.18
Broccoli - <i>Brassica oleracea</i> var. <i>italica</i>		0.48	0.59	0.49	3.10	1.26	0.34		1.26
Leek - <i>Allium ampeloprasum</i> L.	2.73	2.27	2.09	2.57	1.98	0.94	0.26	-65.57	-1.79
Asparagus - <i>Asparagus officinalis</i> L.	0.10	0.10	0.58	0.59	0.77	0.76	0.21	660.00	0.66
Ricula - <i>Eruca vesicaria</i> L.		0.41	0.62	0.10	0.60	0.47	0.13		0.47
Fennel - <i>Foeniculum vulgare</i> Mill.					0.16	0.29	0.08		0.29
Sweet potato - <i>Ipomoea batatas</i> L. Lam.		0.07			0.75	0.21	0.06		0.21
Lambs lettuce - <i>Valerianella locusta</i>	0.67	0.56	0.31	0.39	0.49	0.21	0.06	-68.66	-0.46
Chickpea - <i>Cicer arietinum</i> L.	0.25	0.13	0.13	0.37	0.19	0.20	0.05	-20.00	-0.05
Bobsleigh - <i>Vicia faba</i> L.	0.33	0.45	0.27	0.09	0.17	0.19	0.05	-42.42	-0.14
Jerusalem artichoke - <i>Helianthus tuberosus</i> L.		0.14	0.14		0.21	0.17	0.05		0.17
Pumpkin - <i>Cucurbita pepo</i> L.		0.35	0.20		0.23				0.00
Turnip - <i>Brassica rapa</i> var. <i>rapa</i> L.	0.19							1,362.86	-0.19
Lentils - <i>Lens culinaris</i>		0.10	0.10	0.10					0.00
Capers - <i>Capparis spinosa</i> L.		0.74							0.00
Artichoke - <i>Cynara scolymus</i> L.	0.09								-0.09
Sweet corn - <i>Zea mays</i> convar. <i>saccharata</i> L.	0.09								-0.09
Peas - <i>Pisum sativum</i> L.	0.05								-0.05
<b>TOTAL</b>	<b>341,69</b>	<b>357,68</b>	<b>387,77</b>	<b>364,15</b>	<b>386,16</b>	<b>367,09</b>	<b>100 %</b>		<b>25.40</b>

(Official Journal of the European Union, 2019) which is used in germ inhibitors and for preventing potato sprouting, storing potatoes proved to be a further difficulty for producers without the appropriate technology, which is why there is expected to be a trend of reducing areas of agricultural production in the near future.

### *The Relationship between the Cultivation of Fruit and Vegetables and the Consumption Demands of the Population of the County of Dubrovnik-Neretva*

Table 4 shows a comparison of data showing the ratio of available, agricultural, locally produced fruit and vegetable products and the local demand per capita for the same products (average consumption in the county). Of course, the demand per capita for fruits and vegetables in Dubrovnik-Neretva is certainly higher because, during the tourist season, the number of consumers increases with the arrival of foreign tourists. Also, dietary habits of the inhabitants of the Republic of Croatia are not the same, which is largely determined by their financial capabilities. Therefore, the ratio of disparities in supply and demand is likely to be more pronounced. Unfortunately, data on fruit and vegetable consumption in catering and tourist facilities during the tourist season in the county are unavailable, which applies in particular to facilities offering higher service and price

categories, thus providing a greater possibility of marketing indigenous agricultural products with higher added value.

An analysis of the structure of fruit and vegetable production in Dubrovnik-Neretva shows that in 2017 64.40% of production was related to mandarin and watermelon, while in 2016 and 2018, this percentage was 80%, which is several times higher than the average demand of the county. These crops are mostly bought and marketed throughout the Republic of Croatia, and in some years, due to full storage capacity, market saturation and the inability to process raw materials, a decline is shown in some crops. The category of berries in 2018 satisfied 96.12% of county consumption demands, primarily due to the production of strawberries (89.06% of the berry agricultural production area). The largest deficit of fruit production in relation to the consumption demands of Dubrovnik-Neretva was recorded in apples and stone fruits. In the observed period, peaches, plums and cherries recorded agricultural land decrease by almost 10 ha. Apples recorded an increase in agricultural production areas by 6.42 ha and a significant increase in yield in the observed three-year period (282.20%), but this species shows the greatest disparity between production and demand. Also, the production of nuts in the county is almost negligible.

The lack of vegetable production is mostly related to potatoes and root vegetables. In 2018, potatoes produced in the county met

**Table 4.** Data showing the required quantities, production and differences between demand and fruit and vegetable production in 2016, 2017 and 2018 in DNC (source: Author's calculations based on data provided by the PAAFRD / CBoS)

	Demands (t)	2016		2017		2018	
		Production (t)	Share (%)	Production (t)	Share (%)	Production (t)	Share (%)
<b>Fruit<sup>1</sup></b>							
Tropical fruit	1,152.14	33,171.96	2,879.16	13,584.38	1,179.06	35,288.97	3,062.91
Apples	1,409.53	315.15	22.36	539.58	38.28	889.30	63.09
Pear	208.37	12.38	5.94	9.31	4.47	12.01	5.76
Stone fruit	612.84	232.77	37.98	324.33	52.92	196.98	32.14
Nuts	220.62	0.64	0.29	0.31	0.14	0.42	0.19
Berries	269.65	144.15	53.46	234.08	86.81	259.19	96.12
Other	1,066.34	379.73	35.61	386.84	36.28	757.45	71.03
<b>Total</b>	<b>4,939.49</b>	<b>34,256.77</b>	<b>693.53</b>	<b>15,078.84</b>	<b>305.27</b>	<b>37,404.32</b>	<b>757.25</b>
<b>Vegetables<sup>2</sup></b>							
Leafy	919.26	1,878.02	204.30	1,257.40	136.78	1,660.43	180.63
Fruiting	1,973.34	5,870.19	297.47	6,362.42	322.42	6,704.54	339.76
Root	1,789.49	597.65	33.40	404.99	22.63	244.23	13.65
Potato	4,020.23	715.90	17.81	600.70	14.94	494.08	12.29
Other		3,405.02		4,253.72		4,063.36	
<b>Total</b>	<b>8,702.33</b>	<b>12,466.78</b>	<b>143.26</b>	<b>12,879.23</b>	<b>148.00</b>	<b>13,166.63</b>	<b>151.30</b>

<sup>1</sup> Southern fruits (citrus fruits): mandarin, orange, lemon; Stone fruit: peach, nectarine, plum, apricot, cherry, sour cherry; Nuts: walnut, almond; Berries: choke berry, strawberry, raspberry, blackberry; other fruits: fig, pomegranate, fruit orchards

<sup>2</sup> Leafy vegetables: cabbage, cauliflower, kale, chard, lettuce, broccoli, leeks, rucola, dill, spinach; Fruiting: pumpkin, squash, garlic, tomato, onion, paprika, cucumber, gherkins, beans, pumpkin, eggplant, watermelon, melon; Root: beets, carrots, sweet potatoes, parsley, celery; Other: vegetable plantations

12.29% of the county's demand, and root vegetables, 13.65%. In root vegetables (beets and carrots) there is an obvious decline in production; the total of carrot-growing land in 2015 was 13.86 ha, and in 2020 only 3.67 ha, which is a decrease of 73.52%, while in beets the decrease was 5.24 ha (40.46%). Other counties in the Republic of Croatia are leading in the production of these crops, while the Dubrovnik-Neretva area has just a small share of its own production of sugar beets (6.98%), potatoes (0.39%) and carrots (1.32%) in the total production of the Republic of Croatia (PAAFRD, 2020). Due to a lack of the above-mentioned crops produced in the county, as well as the small share of its production in the Republic of Croatia, these crops cannot achieve food self-sufficiency when it comes to satisfying the food requirements of the county, so they will be supplied from other parts of the Republic of Croatia or otherwise imported. The production of leafy and fruit vegetables (mostly watermelons, garlic, onions, cucumbers and gherkins), which also belong to the self-sufficient groups of vegetable crops, increased.

#### ***Data Collected by Conducting a Structured Interview – Survey of the Main Purchasers of Fruits and Vegetables in the County***

For the purposes of the research, a survey of the most important purchasers of fruits and vegetables in the county was conducted in order to obtain information on the quantities, origin and marketing methods of fruit and vegetable crops purchased, and the share of purchases during the tourist season (1.6.-1.10.), as well as the most sought-after crops that are not produced in sufficient quantities in the county's existing market. The interview covered 2017 and 2018.

##### *Purchase of Fruit*

The total number of fruit purchased from the interviewed purchasers was 7,345,796.32 kg (2017) and 21,794,954 kg (2018). The much higher purchase in 2018 is a consequence of higher yields compared to the previous year due to better climatic conditions. The most common species purchased in both years is mandarin (92.91% and 94.26%). Data from the Croatian Bureau of Statistics (CBoS, 2020a) shows a difference in the yield of mandarins (9.4 t/ha in 2017 and 24.8 t/ha in 2018, an increase of 37.90%), which resulted in a significantly higher share in the total purchase. The rest of the fruit is purchased in negligible quantities: strawberries (2.53%), clementine (1.05%), grapes (1.05%), plums (0.80%), nectarines (0.55%), peaches 0.53%), pomegranates (0.51%) and apples (0.07%) in 2017 and clementine (2.21%), strawberries (1.15%), plums (0.67%), grapes (0.61%), nectarines (0.54%), peaches (0.40%), pomegranates (0.10%) and apples (0.06%) in 2018 (CBoS, 2020a).

##### *Purchase of Vegetables*

The total number of vegetables purchased from the surveyed purchasers was 12,173,345.86 kg (2017) and 15,252,026.00 kg (2018). The most common vegetable species purchased in both years are watermelons (46.34% and 49.86%), cabbage (17.20% and 15.28%) and cauliflower (9.70% and 8.42%). Other crops purchased in 2017 are melon (6.83%), kale (5.27%), zucchini

(3.48%), lettuce (3.02%), paprika (1.99%), cucumber (1.81%), tomatoes (1.77%), potatoes (1.67%), chard (0.72%), leeks (0.12%) and eggplant (0.08%), and in 2018 melons 5.90%, kale (4.90%), zucchini (3.33%), lettuce (3.74%), paprika (2.15%), cucumber (2.00%), tomato (1.72%), potatoes (1.49%), chard (1.01%), leek (0.11%) and eggplant (0.09%).

Almost the entire range of fruits purchased in 2017 and 2018 was grown in the county of Dubrovnik-Neretva. Among the purchasers interviewed, the share of fruit from the county in the total purchases was 93.18% in 2017 and in 2018 96.91%. For vegetables, this share in 2017 was 71.51%, or 73.13% in 2018. All purchasers market the goods bought through large retail chains (domestic and foreign). A smaller amount is sold in Zagreb at the wholesale market and through smaller commercial economic entities. According to the purchasers' replies, the following vegetable crops are absent in their purchases: peppers, tomatoes, cucumbers, leeks, first early potatoes, lettuce and celery. Unfortunately, at the same time, there is a lack of official data on the amount of imported vegetables and fruit in the county. According to these purchasers, the crops listed are the ones that are mostly imported, due to their not being produced domestically.

The situation is similar with fruit; lemons, oranges and clementines are the three fruit species that are imported in the largest quantities. The share of mandarin and watermelon purchases among the purchasers interviewed in 2017 was 65%, while in 2018 the share was 76% of the total purchase.

The purchasers interviewed from the Neretva area estimate that about 30% of the total annual purchase is realised during the tourist season, noting that mandarins are purchased after the tourist season. From the above data it can be seen that during the tourist season (1.6.-1.10), when there is an increase in the population in Dubrovnik-Neretva and demand for food products, there is no significant increase in the purchase of fruits and vegetables from those purchasers interviewed. It follows from the above that retail chains are supplied with goods that come from the rest of the Republic of Croatia or are imported during the tourist season and at times when there is an increase in demand.

From a comparison between data on fruits and vegetables produced in Dubrovnik-Neretva and data on the purchases of the purchasers interviewed, it turned out that a large part of production is purchased, i.e. that it is intended for marketing instead of personal consumption. Namely, a comparison of the above data shows that 50% and 60% of the fruit cultivated was purchased while 70% and 80% of vegetables were purchased in 2017 and 2018 respectively. These figures are unlikely to be accurate, given the high number of farms and mixed fruit and vegetable plantations whose production is primarily intended for personal consumption. These discrepancies point to insufficient institutional monitoring of agricultural production in the county or in the Republic of Croatia. In order to monitor the development of this agricultural segment, accurate institutional supervision of the production and marketing of fruit and vegetables is necessary, as emphasised in the Draft Agriculture Sector Strategy 2020-2030 (update of the Fruit Register for better insight into production and its integration into the Central Information System).

### ***Trends in Fruit and Vegetable Production in the County of Dubrovnik-Neretva***

Improving the factors that affect the quality of fruit and vegetables can raise the value of the final product that would meet the market demand for top quality fresh fruit and vegetables, which is increasingly characterised by modern consumer society (Kyriacou and Roupheal, 2018). According to the predispositions of the county (climate, soil and assortment etc.), and with additional progress, primarily in the form of investment in the modernisation of production, storage and processing, it is possible to make significant progress in diversification, quantities and quality of fruits and vegetables. Full self-sufficiency for Dubrovnik-Neretva in the production of fruits and vegetables is not necessarily provided by the conditions of the existing market, but an increase in the production of certain crops is inevitable in order to make progress in this sector.

For the further development of mandarin cultivation, one of the most important crops of the county, it is necessary to improve the system of fruit marketing further in order to avoid the appearance of excessive, non-purchased quantities in a short period of time on the market, which has happened in recent years. Producers in the Neretva Valley face problems such as unstable purchase prices, non-compliance and manipulation in respect of the Law on Unfair Commercial Practices, which creates a loss for the producers due to imported mandarins being sold below the purchase price (Bjeliš et al., 2019). In order to increase yields and for better marketing, it is necessary to do research on the earlier variety that ripens in mid-September and achieves the best price on the market, while the price of mandarins that ripen later falls by 70% in relation to the starting price (Kaleb, 2014). As the Neretva Valley is dominated by the Unshiu owari variety, there is a problem with the purchase since a certain amount of fruit is found on the market during a certain period of time, which is why it is necessary to build ancillary finishing and processing facilities for mandarins, as well as to explore new markets and safeguard the marketing of mandarins. With the introduction of new production technologies and better organisation of the fruit trade, Croatia can achieve a much more favourable purchase price and increase the profitability of this crop.

Apart from mandarins, other citrus fruits also play a role in this area. According to the Ministry of Agriculture, oranges and lemons make up the majority of fruit imports in the Republic of Croatia, have the lowest self-sufficiency of all fruit species in the Republic of Croatia (in 2017 - lemons 0.40% and oranges 0.25%) and above-average wholesale price (Ministry of Agriculture, 2019). Although in 2019 68% of lemon and orange production (a total of 32.15 ha in the Republic of Croatia) took place in the Neretva Valley, part of the production was recorded in Konavle (1.38 ha) and on the islands of Vis (3.56 ha), Hvar (1.17 ha) and Brač (0.77 ha) (PAAFRD, 2020). Growing space for these crops is limited by the demand for a large amount of heat during the growing season, deep and well-drained soils and resistance to strong winds and low temperatures (Miljković, 1991), so only certain locations within the county are suitable for their cultivation. Lemon and orange production in Dubrovnik-Neretva in 2020 occupied 29 ha (Table 2) with a significant increase in agricultural production areas (lemon 299.41% and orange 162.61%) in the observed period (2015-2020). Due to all the above, we believe that because

of the possibility of cultivation and demand, as well as the current smaller agricultural production areas, the production of these fruit crops will continue the current growth trend.

The county of Dubrovnik-Neretva should strive for greater production of important vegetable crops, such as tomatoes, peppers, cucumbers and cabbage, which would be based on better utilisation of available capacities and increased production intensity. The data shows that in the period 2015-2020 there was an increase in the area cultivating peppers, cucumbers and cabbage, while in tomatoes there was a decrease of 55.46% (Table 3). The production trend in the Republic of Croatia shows that since in 2008, the areas producing tomatoes have been on the decrease, while production is on the increase due to the consolidation of production and the application of appropriate, modern technical-technological production processes (increase in productivity); most of the tomatoes produced are used for fresh use, while only one tenth of the total production is processed. In terms of quantity, in the Republic of Croatia most tomatoes were produced in Dubrovnik-Neretva, where the highest yields were achieved (Grgić et al., 2016). Despite the decline in agricultural production areas during the observed period, the county is still among the leading counties (6<sup>th</sup> place) in terms of agricultural production areas with this crop in 2020.

Lately, consumers have been increasingly looking for more direct relationships with food producers because they want to be informed about the origin and production process of the food they buy. Direct cooperation with consumers by creating short food supply chains could be a great opportunity for small and medium enterprises in the agri-food system (Gajdić, 2019). This possibility is also recognized in the Rural Development Programme through sub-measure 16.4.1. "Short supply chains and local markets." Given the large number of agricultural holdings in Dubrovnik-Neretva, as well as the tourist orientation of the county, which offers the possibility of product placement, it is extremely important to establish a larger number of short supply chains. Diversified agricultural production and the establishment of short supply chains between producers and customers are prerequisites for the further development of agriculture in the county, which is especially emphasised in the Draft Strategy for Agricultural Development for the period 2020 - 2030. The importance of diversified agricultural production that can meet local demand was especially emphasised during the Covid-19 virus pandemic and the quarantine during which the state and county borders were closed, which particularly affected Dubrovnik-Neretva due to its special position within the Republic of Croatia.

### **Conclusion**

The county of Dubrovnik-Neretva has the potential for successful and profitable agricultural production. The analysis of existing data for 2019 shows the use of only 7% (9,625.85 ha) of total agricultural land in the county. The analysis of agricultural production areas showed that the most common fruit species (except vines and olives) are mandarins, figs and watermelons, and in the case of vegetables, mixed vegetable plantations, cabbage and potatoes are the most common. Due to the quantitatively high yields of mandarins and watermelons (80% of production in 2016 and 2018), the total amount of fruits and vegetables produced numerically meets the needs of the county (according to the

calculation method used), but due to insufficient diversification of production it cannot be said that the county is self-sufficient. The biggest disadvantage of fruit production is noticed in apples and stone fruits. The most deficient vegetable species are potatoes and root vegetables, where beets and carrots recorded a large decline in agricultural production areas during the period 2015-2020. A survey of purchasers from the county shows that the most important purchase crops are mandarins, watermelons, melons, cabbage, cauliflower and kale. Among the purchasers interviewed, the share of mandarins and watermelons in the observed period was, on average, 70% of the total purchase, while the share of purchased fruit produced in the county was 93.18% (2017) and 96.91% (2018), respectively. For vegetables, this share is 71.51% (2017) and 73.13% (2018), respectively. The survey identified the most deficient crops, such as lemons, oranges, peppers, tomatoes and cucumbers. Current agricultural production shown in this paper may provide some evidence of future prospects of agriculture in DNC.

## References

- Andabaka Ž., Stupić D., Karoglan M., Marković Z., Preiner D., Maletić E., Karoglan Kontić J. (2016). Historic Development of the Most Important Autochthonous Dalmatian (*Vitis vinifera* L.), Journal of Plant Protection 39 (3): 14-20. (in Croatian)
- Bačić B. (2015). Situation Analysis and Prospects of Fruit and Vegetables Growing in Croatia with Reference to Zadar County. Master Thesis, University of Zadar (in Croatian)
- Bakarić P. (2002). Olive Cultivars in Dubrovnik Littoral. Dubrovnik, Alfa 2 (in Croatian)
- Bakarić P. (2007). Autochthonous Olive Varieties on Elafiti Islands. Dubrovnik, Alfa 2 (in Croatian)
- Bjeliš Ž., Babić M., Filipović I., Blažević T. (2019). Analysis and Guidelines for Mandarin Cultivation in the Neretva Valley. Opuzen, Croatia. Available at: <https://cdn.agroklub.com/upload/documents/analiza-i-smjernice-proizvodnje-mandarina.pdf> [Accessed 17.09.2020.] (in Croatian)
- Čmelik Z. (2010). Classic (extensive) Orchards in Croatia. Pomologia Croatica 16: 3-4. (in Croatian)
- Croatian Bureau of Statistics (2003) Agricultural Census 2003. Zagreb Available at: [https://www.dzs.hr/default\\_e.htm](https://www.dzs.hr/default_e.htm) [Accessed 19.06.2020]
- Croatian Bureau of Statistics (2018). Statistical Yearbook of the Republic of Croatia. Zagreb Available at: [https://www.dzs.hr/Hrv\\_Eng/ljetopis/2018/sljh2018.pdf](https://www.dzs.hr/Hrv_Eng/ljetopis/2018/sljh2018.pdf) [Accessed 19.06.2020]
- Croatian Bureau of Statistics (2019). The Household Budget Survey – Basic Characteristics of Household Consumption, 2017 Available at: [https://www.dzs.hr/Hrv\\_Eng/publication/2018/14-01-02\\_01\\_2018.htm](https://www.dzs.hr/Hrv_Eng/publication/2018/14-01-02_01_2018.htm) [Accessed 20.06.2020]
- Croatian Bureau of Statistics (2020a). Table 4 Intensive Area, Production of Fruits, Grapes and Olives and Yield in Hectares, Tonnes and t/ha, Republic of Croatia and Spatial Units for Statistics of 2nd Level. Available at: [https://www.dzs.hr/default\\_e.htm](https://www.dzs.hr/default_e.htm) [Accessed 17.06.2020]
- Croatian Bureau of Statistics (2020b). Table 3 Intensive Harvested Area, Production of Vegetables and Yield in Hectares, Tonnes and t/ha, Republic of Croatia and Spatial Units for Statistics of 2nd Level. Available at: [https://www.dzs.hr/default\\_e.htm](https://www.dzs.hr/default_e.htm) [Accessed 17.06.2020]
- Gajdić D. (2019). Definition and Characteristics of Short Agri-Food Supply Chains for Products. Economic Thought and Practice 1: 381-408. (in Croatian)
- Grgić I., Hadelan L., Baškarić L., Šmidlehner M., Zrakić M. (2016). Vegetable Production in the Republic of Croatia: Current Situation and Opportunities. Journal of Plant Protection 39 (5): 14-22. (in Croatian)
- Grgić I., Ivanković M., Čagalj M., Miličević M., Zrakić Sušac M. (2019). Organic Agricultural Production of Croatia and Tourism. Journal of Plant Protection 42 (4): 8-13. (in Croatian)
- Husnjak S. (2016). Determination of Land Capability Class in the County of Dubrovnik-Neretva with Soil Mapping at a Scale of 1:100 000. Zagreb. (in Croatian)
- Ires ekologija (2016). Air Protection Plan for the Protection of Air, Ozone Layer and Climate Change Mitigation in the County of Dubrovnik-Neretva for the Period 2017 - 2020 (2016). Strategy Developer: Ires ekologija (in Croatian)
- Kaleb M. (2014). Development of Mandarin Culture and Other Citrus Species in the Neretva Valley. Agronomy Journal 76 (4-5): 219-238. (in Croatian)
- Kantoci D. (2006). Fruit Growing. Journal of Plant Protection 29 (5): 4-20. (in Croatian)
- Kyriacou M.C., Roupael Y. (2018). Towards a New Definition of Fresh Fruits and Vegetables. Sci Hort 234: 463-469
- Lešić R., Borošić J., Buturac I., Herak-Čustić M., Poljak M., Romić D. (2004). Vegetable Growing. Zrinski, Čakovec (in Croatian)
- Marić M., Paladin I. (2017). Establishment of Citrus Mother Blocks in Croatia. Pomologia Croatica 1-2: 71-89. (in Croatian)
- Matotan Z. (2008). Fruitful Vegetables 1. Neron, Bjelovar (in Croatian)
- Meijerink G., Roza P. (2007). The Role of Agriculture in Development. Markets, Chains and Sustainable Development Strategy and Policy Paper 5: 1-33
- Miljković I. (1991). Modern Fruit Growing. Znanje, Zagreb (in Croatian)
- Miljković I. (1996). New Guidelines in Fruit Growing in Croatia. Agronomy Journal 58 (2-4): 123-141. (in Croatian)
- Ministry of Agriculture (2019). Annual Report on the State of Agriculture in 2018. Ministry of Agriculture, Zagreb (in Croatian)
- Ministry of Agriculture (2020). Draft of Agricultural Strategy 2020.-2030. Ministry of Agriculture, Zagreb (in Croatian)
- Official Journal of the European Union (2019) COMMISSION IMPLEMENTING REGULATION (EU) 2019/989 of 17 June 2019 Concerning the Non-Renewal of Approval of the Active Substance Chlorpropham, in Accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council Concerning the Placing of Plant Protection Products on the Market, and Amending the Annex to Commission Implementing Regulation (EU) No 540/2011 Available at: <https://eur-lex.europa.eu/legal-content/HR/TXT/HTML/?uri=CELEX:32019R0989&from=FR> [Accessed 25.10.2020]
- Ozimec R., Karoglan Kontić J., Maletić E., Matotan Z., Strikić F. (2015). Traditional Varieties and Breeds of Dalmatia. Zagreb, United Nations Development Programme. (in Croatian)
- Paying Agency for Agriculture, Fisheries and Rural Development (2015). Requested Cultures on Unique Request from 2015. Available at: <https://www.aprrr.hr/agronet/>. [Accessed 01.04.2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2016). Requested Cultures on Unique Request from 2016. Available at: <https://www.prrr.hr/agronet/>. [Accessed 03.04.2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2017a). Requested Cultures on Unique Request from 2017. Available at: <https://www.aprrr.hr/agronet/>. [Accessed 06.04.2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2017b). Number and Area of ARKOD by Settlements and Type of Agricultural Land Use for 2016. Available at: <https://www.aprrr.hr/arkod/>. [Accessed 09.04.2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2018a). Requested Cultures on Unique Request from 2018. Available at: <https://www.aprrr.hr/agronet/>. [Accessed 08.04.2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2018b). Number and Area of ARKOD by Settlements and Type of Agricultural Land Use for 2017. Available at: <https://www.aprrr.hr/arkod/>. [Accessed 12.04.2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2019a). Requested Cultures on Unique Request from 2019. Available at: <https://www.aprrr.hr/agronet/>. [Accessed 09.04.2020]

- Paying Agency for Agriculture, Fisheries and Rural Development (2019b). Number and Area of ARKOD by Settlements and Type of Agricultural Land Use for 2018. Available at: <https://www.aprrr.hr/arkod/>. [Accessed 12 04. 2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2020a). Requested Cultures on Unique Request from 2020. Available at: <https://www.aprrr.hr/agronet/>. [Accessed 10 04. 2020]
- Paying Agency for Agriculture, Fisheries and Rural Development (2020b). Number and Area of ARKOD by Settlements and Type of Agricultural Land Use for 2019. Available at: <https://www.aprrr.hr/arkod/>. [Accessed 10 05. 2020]
- Šegota T., Filipčić A. (2003). Köppen's Classification of Climates and the Problem of Corresponding Croatian Terminology. *Geoadria* 8 (1): 17-37. (in Croatian)
- Šugar T., Bršić K (2019). Consumers' Perceptions of Organic Food Products in Croatia. *Ekonomski vjesnik* 33 (1): 227-241 (in Croatian)
- Timmer C. P. (2002). Agriculture and Economic Development. *Handbook of Agricultural Economics* 2: 1488-1536.
- Tourism Development Strategy of DNC for the Period 2012.-2022. (2013). Strategy Developer: Horwath Consulting Zagreb (in Croatian)

---

aCS86\_22