

# Food production and security in the area of Serbia: historical background and current situation

Vesna Đorđević<sup>1</sup>, Milorad Mirilović<sup>2</sup>, Nenad Katanić<sup>3</sup>, Jelena Janjić<sup>2</sup>, Drago Nedić<sup>2</sup>, Danijela Šarčević<sup>1\*</sup>, Milan Ž. Baltić<sup>2</sup>

*Abstract:* Today's civilization finds itself facing existential problems in the survival of life on planet Earth. The aim of this paper is to point out the importance of food production from the moment when humans became hunter-gatherers until today, when there is talk about food security from the aspect of providing sufficient amounts of food for present and future generations. The paper presents the production of food in Serbia since the arrival of Slavic tribes on the Balkan Peninsula up to modern times. The paper also points to the historical development of food production and the necessity for socially responsible behaviour to preserve the resources we have for future generations.

**Keywords:** Serbia, history, food production, food safety.

## Introduction

Today's civilization is facing existential problems of survival, but the most important of them is food. From the time when man moved from a hunter-gatherer lifestyle, and especially from the time of the first organized civilizations (Egypt, China), the creation of food supplies for lean times has been a concern (Nićiforović-Babac, 2009). Humans consciously and instinctively care about food supplies and food security. To describe the situation in which sufficient amounts of food are available, we use the term "food security", which was defined as: "When all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2002; *Food Security*, 2006). According to data from the Food and Agriculture Organization of the United Nations (FAO), 850 million people in the world (11% of the world's population) are chronically malnourished, and in one year, 5,642 million children under the age of five, and 959,000 children between the ages of five and fourteen die of hunger (Fan and Polman, 2014; Hug et al., 2017).

Increasing agricultural production and reducing the amount of food wasted (lost) are ways to reduce the number of malnourished populations and mor-

tality due to starvation. According to the FAO definition, famine is a condition when a person does not eat enough food to meet their energy needs (1800 kcal per day) for a healthy and active life. Famine can also be defined as malnutrition in situation when a person does not intake enough macronutrients (proteins, fats, carbohydrates) or micronutrients (vitamins, minerals). Today, two billion people in the world are considered to be malnourished, which is often referred to as "hidden malnutrition". When it comes to macronutrients, the most common cause of malnutrition is insufficient protein intake. Micronutrient deficiencies usually involve vitamin A, iron, iodine and zinc. For society, famine and malnutrition have undoubted economic significance through health care expenditure, reduced working capacity etc. According to FAO estimates, famine and malnutrition in the world is expected to end between 2025 and 2030 (Fan and Polman, 2014).

## People and life on earth

Since the beginning of human species, people's life on planet Earth has depended on the gifts of nature. More than two million years ago, archaic human species ate plants and their fruits, as well as animal meat. This, long before the beginning of agriculture, was the time when humans separated from other animals, i.e.,

<sup>1</sup>Institute of Meat Hygiene and Technology, Kačanskog 13, 11000 Belgrade, Serbia;

<sup>2</sup>University in Belgrade, Faculty of Veterinary Medicine, Bulevar Oslobođenja 18, 11000 Belgrade, Serbia;

<sup>3</sup>Ministry of Agriculture, Forestry and Water Management, Nemanjina 22–26, 11000 Belgrade, Serbia.

\*Corresponding author: Danijela Šarčević, [danijela.sarcevic@inmes.rs](mailto:danijela.sarcevic@inmes.rs)

stood up (*Homo erectus*), began to use their hands to make tools, and moved from gesticular to mutual verbal communication. Later, in the period before around 200,000 years ago and according to skeletal remains, anatomically modern people mostly lived in small groups of around 20 members (Baltić and Bošković, 2015; Hailicwkes, 1966; Vuković, 2015).

This long historical period was when great progress was achieved in tool making, perfecting and gaining experience in hunting, and acquiring knowledge of the plant world and its seasonal changes. At this time, humans experienced the connection between diet and health (Baltić et al., 2010). The first farmers began to domesticate animals and cultivate plants 10,000 to 12,000 years ago. Nowadays, *Homo sapiens* cannot survive without agriculture. The world's first civilizations were associated with agriculture, i.e., cultivation of wheat and barley in the area south of the Caspian Sea, Kurdistan and Levant around 8,000 B.C., rice in China about 6,000 B.C. and corn in Central America, cultivated by Aztecs by 7,000 B.C. (Nićiforović-Babac, 2009; Heun et al., 1997; Yval, 2014). There is no doubt that agriculture changed the world in all aspects of its existence, both natural and social.

### Food security on the Balkan Peninsula

The Balkan Peninsula was inhabited by Neanderthal people more than 25,000 years ago, in the Pleistocene. This is evidenced by the traces of people in numerous caves in the lands now encompassed by Serbia, of which the cave near the village of Gradac, under Jerina hill (Batočina) and Risovača on Venčac (Arandjelovac) are most often mentioned. These people were hunter-gatherers, and they mastered the skills to process the stones and bones that they used in hunting. When climate change reduced their food resources, they left their home ranges (more expressed in the ice age periods) (Gavela, 1962; Srejšević, 1978; Ilić, 1995). The Holocene, the next geological epoch in the development of the countries in the Balkans, including Serbia, was marked by the cultures of Lepenski vir (9000-4500 BC), Starčevo (5300-4400 BC) and Vinča (4400-3200 BC), which belong to the Neolithic (Srejšević, 1978; Borić and Dimitrijević, 2007; Garašanin, 1973; Filipović et al., 2018; Diklić, 2017). The most distinct traces of these cultures are in the places that bear their names, but there are also some in other parts of the Balkan Peninsula, i.e., north and south of the Sava and Danube rivers. From the time of Theodosius II in the 5<sup>th</sup> century to the dynasty of Her-

acius in the 7<sup>th</sup> century, Slavs migrated to the area of the Eastern Roman Empire — Byzantium. They came from their ancient homeland which was the area of the Carpathians, i.e., around the Dnieper and Bug rivers (Ostrogorski, 1996). The Eastern Roman Empire fell in 1453 after centuries of fighting with the Ottoman Empire, but also as a consequence of the conflict of peoples within the empire itself. That was time when the Serbian states, which were part of Byzantium, also disappeared (Ostrogorski, 1996).

Since their arrival on the Balkan Peninsula, and even during the medieval period, Serbs adhered to their traditional diet. Perhaps, the best indication of this is the fact that when they migrated to the Balkans, they took with them to the area a primitive breed of pig known as Šiška (Hrasnica et al., 1964). There is not much information about how they lived or how they ate in the first centuries after they settled in the Balkans. However, it must be assumed that in the new conditions, they acquired new habits and had to adapt to a new environment. The area they came from was rich in water and fish. In such an environment, it is quite understandable that they were skilled boat builders and were good fishermen. For these strong people, the Balkan Peninsula, in relation to their homeland, was arid. However, it cannot be claimed that in their ancient homeland they lived only from fishing. Those vast lowland areas were suitable for livestock, agriculture and hunting (Ivanović et al., 2012). In Serbia at the time of early Slav settlement, the most important food resources were oak forests, because of acorns and their importance in pig nutrition, and mountain pastures. In the time of Emperor Dušan (14<sup>th</sup> century), deforestation was banned and restrictions on ploughing forest pastures began. Cattle, sheep and horses were fed on mountain pastures in summer, and in valleys and plains in winter. Pigs lived permanently in the oak and beech forests and were not moved.

In medieval Serbia, livestock breeding was the main branch of the economy. Practically the entire population was engaged in livestock breeding and/or agriculture. Emperors, nobles and the priesthood directed Serbs to engage in various forms agriculture, like fruit growing, beekeeping and their associated crafts, and the people named Vlachs to engage in livestock breeding. In medieval Serbia, the term Vlachs referred to livestock breeders of different ethnic origins (Serbian, Romanian, Greek). They lived in *katuns*, seasonal huts and settlements mentioned in documents in the 12<sup>th</sup> and 13<sup>th</sup> centuries. Thus, the population of Serbia was divided into those who were mainly engaged in plant-based agriculture and those whose main activity was animal husbandry. Villag-

es were located on the plains or at the foot of mountains, while the *katuns* were in the mountains to take advantage of summer pastures (Cvijić, 1991).

There are no data about the number of livestock in Serbia in the early 12<sup>th</sup> century. However, in the medieval Serbian state, livestock breeding was the most advanced form of agriculture from the time of King Milutin (1282–1321), and reached a peak during the rule of Emperor Dušan (1331–1355) (Radojević *et. al*, 2011). Livestock was the people's basic capital, and the animals served instead of money, as a means of payment, and even for the payment of fines. The importance given to livestock breeding and grazing is also shown by the fact that several articles in Dušan's Code regulate this area ([www.iksi.ac.rs](http://www.iksi.ac.rs)).

Sheep and pigs were the most commonly raised livestock, followed by cattle, horses, goats, buffaloes and poultry. The flocks of sheep were huge, as evidenced by the fact that in 1398, the Ottomans captured about 5,000 sheep from Dubrovnik merchants. In the area of Branković in 1455, the Ottomans registered over 25,000 pigs, i.e., more than two pigs per family (Spremić, 1994). However, most of the large animals were cattle. Emperors, nobles and monasteries kept the most cattle on their estates. Most often, one ordinary household had two oxen, two to four cows, three to four pigs and 10 to 20 sheep and goats. There were also poultry, especially chickens. In summer, small and large livestock animals were kept near rural households, and in winter, the animals were moved indoors, into barns (Blagojević, 1989). Domestic pigs reached weights of about 100 kilograms, and cows gave two to three litres of milk per day.

Households were engaged in agronomy, raising wheat, barley, rye and millet and in olericulture, raising vegetables such as cabbage, onions and beets. In Serbia at that time, the semi-nomadic Vlachs engaged in livestock breeding and production of food of animal origin. Between 20 and 100 families lived in each *katun* settlement at altitudes over 1,000 meters above sea level (Cvijić, 1991). The main product of these livestock breeders was cheese made from sheep's milk (Tomić, 1922). In addition to sheep, professional breeders kept a small number of cattle and horses; the horses served as pack animals. The Arbanassis people, mentioned in the 11<sup>th</sup> century, led a similar life to the Vlachs. The use of pastures and forests to feed livestock was taxed and paid for in grain, animals, meat, honey, wax or cheese. During Emperor Dušan's rule, one head of cattle was given to over-winter 100 cattle or horses on manorial lands, and four sheep with a lamb were paid for over-wintering 100 sheep (Jiriček, 1923). Pigs were fed on acorns in oak forests, and the

ruler took from each pig owner a fee (tax) called *zhirovina* that amounted to 10% of the number of pigs. Charters from that time mention the *svinjski desetak* (literal translation; about ten for pigs). The fee paid to nobles or monasteries for the use of their forests and/or pastures could also be in money (Jiriček, 1923; Arsić, 2010). When livestock were sold, the ruler's animals (their own or those obtained as a *desetak*) had to be sold first. The same principle was used when they sold meat or meat products. The meat was sold fresh, and professional butchers are mentioned in most Serbian cities. There were also regulations around the sale of meat. Despot Stefan Lazarević, in Novo Brdo, also prescribed the price of meat (Marković, 1985). In addition to fresh meat, canned, salted and dried meat was also traded. Salted and dried pork was exported, and Dubrovnik merchants were noted traders of these products. By then, the majority of the population were used to bacon and lard in their diet. In medieval Serbia, besides meat from domestic animals, venison and other game meats were also used in the diet. Wild boar, chamois, deer, rabbit, wild duck, wild goose, partridge and pigeon were hunted (Mišić, 1992). Also, beekeeping existed as a professional occupation. Rulers, nobles and monasteries had their own beehives. Beekeeping was also taxed, so there was a *pčelinji desetak*. In 1455 in the Branković area, the Ottomans listed all the beehives; that list shows that many households had beehives, with some of them having more than a dozen beehives (Novaković, 1912).

Livestock products were mainly meat, especially salted pork, and cheese, then leather, wool and horns. In this period, new cities like Novo brdo, Prizren and Prishtina were just beginning to develop. The majority of the population lived in the countryside, so agriculture and livestock farming, along with mining, formed the basis of the economy. Serbia had significant quantities of grain and was a well-known grain exporter; again, the best buyers were Dubrovnik merchants. Grain was ground in mills owned by rulers, nobles, monasteries, cities, or also ordinary people (Jiriček, 1922).

Fish was an important item in the diet of the population of Serbia. In medieval Serbia, fish originated from rivers, lakes and sea. The Despot Stefan Lazarević Law on Mines was partly dedicated to the quality of fish, but it also referred to the trade of meat (Radojčić, 1960). The monasteries were the biggest consumers of fish, especially during religious holidays (when a form of fasting was required that denied meat from warm-blooded animals but allowed fish consumption). Fish was often on the menu of nobles and rulers. Monasteries and rulers had their own

fish ponds. While freshwater fish were mostly traded fresh, marine fish were usually salted to prevent quick spoilage. Seafoods like octopus, cuttlefish and shellfish were also valued (*Sprenić, 2004*).

It cannot be said that in the medieval period there was always enough food for everyone in Serbia; famine years occurred in almost every decade. Famine years, during which people ate acorns, roots, grasses, leaves and tree bark, were mostly caused by droughts, hail, floods or frosts. After these types of natural disasters that were the cause of food insufficiency, war was the next most common reason for famine years. Usually, opposing sides fought during the summer, and then an army would destroy the grain or deplete the population by encircling and besieging the cities. In the early medieval period, both in Europe and in Serbia, corn, potato, sunflower, sugar beet and soybean were unknown crops. There is no doubt that these crops have significantly changed agricultural production and, thus, the diet of people in the “Old World”. Corn was brought to Europe in the late 15<sup>th</sup> or early 16<sup>th</sup> century. Sunflowers have been grown in Europe since the 17<sup>th</sup> century, although more significant areas were sown after the Second World War. Soybeans have been grown extensively in America since the 19<sup>th</sup> century, and in Europe after the Second World War. Beans were brought from the Americas in 1542, and in the 17<sup>th</sup> century, were introduced from Italy to the Balkan Peninsula. Potatoes were brought to Europe from South America in the 16<sup>th</sup> century. Dositej Obradović introduced potatoes to Serbia during the First Serbian Uprising (1804–1813) (*Baltić and Marković, 2017*).

### Food production in Serbia in the 19<sup>th</sup> century

At the beginning of the 19<sup>th</sup> century, there had been no significant changes in agriculture in Serbia since medieval times. Livestock breeding was still the main activity of the population. However, the structure of agricultural production was changing over time, i.e., agronomy finally prevailed, and livestock movements gradually decreased and have practically disappeared today. Significant changes in agricultural production took place in Serbia at the end of the first half of the 19<sup>th</sup> century. From the medieval period until the 19<sup>th</sup> century, the largest part (75%) of Serbia south of the Sava and Danube rivers was forested. In the second half of the 19<sup>th</sup> century, there was a great reduction in the area under forests. People cut down forests and turned the lands into pasture and arable land for agriculture (*Lazarević and Lazarević, 2016*).

Agronomy then became the basic occupation in agriculture. As it was still being developed, though, it could not provide meaningful surpluses of corn, wheat, barley, oats or rye. However, the favourable configuration of the land, its soil structure and the climate enabled farmers to produce vegetables, fruit and livestock, which allowed them to provide for most of their personal food needs.

Agriculture brought Serbia increasing economic benefits over time. Serbia became independent as a state, so surplus agricultural production, especially livestock (pigs, cattle), was exported to Austria-Hungary. In 1875 during the rule of Milan Obrenović, Serbia had 1,352,500 inhabitants in five regions: Šumadija, Mačva, Rujno, Stari Vlah and Raška-Timočka Krajina-Braničevo, and in the city of Belgrade. Most (90%) of the population, was engaged in agriculture. The first livestock inventory in independent Serbia was made in 1867 during the reign of Mihailo Obrenović, when it was determined that there were 5,284,103 livestock animals. Of that number, sheep constituted over 50.7%, pigs made up 24.4%, cattle accounted for 14.0%, goats for 8.5% and horses for 2.3%. From 1867 to 1872, an average (six-year average) of 28,921 cattle, 385,719 pigs and 45,267 sheep and goats were exported annually. Of the field crops, corn accounted for 55% of the sown area and wheat for 31%, followed by barley, oats, rye, millet and buckwheat. Large quantities of grain, mostly wheat, were exported. Thus, in 1868, 59,000 tons of wheat were exported from Serbia (*Milićević, 2005*).

On the expansion of Serbia's borders after the end of the war with the Ottoman Empire in 1878, Serbia gained four new districts (Niš, Piroć, Vranje and Toplica), in which in 1884 there were 321,772 inhabitants. In the same year, based on inventory data, it was determined that there were 21,355 horses and donkeys, 112,109 cattle, 61,586 pigs, 352,914 sheep and 119,268 goats in these four districts (*Milićević, 2006*).

In addition to livestock, products of animal origin such as meat products, cheese, tallow, wool, leather and horns were also traded. At the time of Prince Milos's rule (mid-1800s), Serbia did not have a foreign trade deficit, because it exported ten times more than it imported (*Vučković, 2005*).

The favourite vegetables of the population of Serbia were cabbage, beans (pulses), onion, tomato, and then potato in the 19<sup>th</sup> century (from the time of Karadjordje in the early 1800s). Broad beans and lentils were more rarely used in the diet. However, the most important vegetable was bell pepper (capsicum, locally called paprika) (sometimes very hot types).

In all towns in Serbia, huge quantities of bell peppers were a characteristic of markets in the autumn. In summer, bell peppers were eaten raw, and in autumn they were sun-dried in wreaths on the external walls of houses for consumption over the winter. Bell pepper was more a staple vegetable in the diet, not just a spice. Pickles were prepared from assorted vegetables for winter consumption. The traditional types of fruit in Serbia were apples, pears, blackberries, blueberries, strawberries and the red plum named *ranka*. The Ottomans brought peaches, apricots, medlars and some types of plums (*požegače*, for example) to Serbia. Spinach, cauliflower, kale and kohlrabi were unknown in Serbia in the 19<sup>th</sup> century. Of all the types of fruit in Serbia, the most widespread was the plum, so it was a significant source of income for the local population. Most of the plum products, such as prunes, jams and plum brandies, were intended for export (Cvijić, 1991; Kanic, 1985a).

### Food production in Serbia in the 20<sup>th</sup> and 21<sup>st</sup> centuries

Just as agriculture changed the world, it also changed Serbia. The country has also gone through a phase of deforestation with the aim of obtaining a larger arable land area to be used for crop and animal farming, and fruit cultivation including viticulture and olericulture. In the 20<sup>th</sup> and 21<sup>st</sup> centuries, this deforestation especially refers to the part of Serbia south of the Sava and Danube rivers. North of these rivers, however, the land has also undergone metamorphosis. There, a network of canals excavated in the 18<sup>th</sup> and 19<sup>th</sup> centuries was completed in the 20<sup>th</sup> century. It drained the land and made the wetland one of the most fertile soils in Europe (Baltić and Marković, 2017). In Serbia, agriculture, and some branches especially, depended on differences in geographic relief and climate, soil richness, forms of land ownership, and people's way of life and religion. Livestock breeding has always had a special place in agriculture. In the world, as well as in Serbia, the relationship and importance of certain cultivated animal species and nutritional plants has changed over time (Cvijić, 1991; Milićević, 2005; Milićević, 2006; Lazarević and Lazarević, 2016).

There have been changes in pig breeding. As the areas under grain (corn, wheat and barley) or in orchards, vineyards, and vegetable gardens increased at the beginning of the 20<sup>th</sup> century at the expense the forests, so gradually greater numbers of people switched to feeding pigs on grain (corn in particular). Until the Annexation crisis and the Customs War

(1906–1908), the export of live cattle enabled significant prosperity for Serbia. Pork fat was actually very important for Austria-Hungary. In the powerful Austro-Hungarian empire, military service was mandatory and it was necessary to provide sufficient amounts of energy sources in soldiers' diets. The simplest and easiest means was to provide dietary energy by using pork fat. Vegetable oils at that time were rarely used in people's diets (Baltić *et al.*, 2010; Bošković *et al.*, 2015). The Customs War forced Serbia to start developing its own slaughter industry and meat processing. Meat products were exported to England, Italy, Switzerland, France and Algeria. Serbia exported over 9,000 tons of meat products in 1908. For Serbia as a rural country, the primary goal of the rural economy was maintenance of the rural family, which was the basic economic and consumer unit. In 1912, meat production in the regions south of the Sava and Danube rivers was at the level that that part of Serbia has today. Agriculture enabled Serbia to acquire and maintain one of the most modern armed forces in the world before the First World War (Baltić *et al.*, 2010).

At the beginning of the 20<sup>th</sup> century, agronomy became an increasingly important activity. The land was arable, the inhabitants cultivated it with pleasure, and in good years there was enough food for even the poorest. The fields were, for the most part, under corn but with some wheat. As a rule, corn gives better yields than wheat, the grain is used for human and livestock nutrition, and the stalks for livestock nutrition. Nowadays, the granaries of Serbia are in Vojvodina (the north) and the river valleys. Corn is the most commonly grown grain for livestock feed and for export. Wheat production meets the local need for bread. Other cereals, like barley, oats and rye, are cultivated mostly for livestock nutrition (Lazarević and Lazarević, 2016).

In the 20<sup>th</sup> century, the world intensified agricultural production from decade to decade, even from year to year, which was quite understandable for a century in which the population tripled, i.e., increased from two to six billion. This number of inhabitants has necessitated constant increases in food production. This was achieved thanks to progress in many areas of life. Numerous measures, both in new plant varieties, fertilizers, irrigation and plant protection as well as in livestock management like changes in breed and composition, selection, diet, housing conditions, etc. have progressed the most important branches of agriculture. Serbia did not lag behind the world in that respect either. In arable farming, yields per unit area have increased substantially. Thus, the wheat yield in

1939 was 1,390 kilograms per hectare, while at the end of the 20<sup>th</sup> century, it was 4,483 kilograms per hectare (*Statistical Yearbook of Serbia and Montenegro*, 2000–2011). The corn yield increased from 1,670 kilograms per hectare in 1939 to 7,900 kilograms per hectare in 2020 (*Statistical Yearbook of RS*, 2021). Part of the land area was sown with silage corn, which accounts for 1% of the total sown area of this grain, with the yield of silage corn per hectare exceeding 20 tons (*Statistical Yearbook of RS*, 2021). The yields of rye, barley, oats, sugar beet, sunflower and soybeans have also increased greatly. There was also a change in the structure of sown field crops. After the Second World War in 1947, close to 37% of arable land was sown with wheat, and 46% with corn. Fifty years later, 30% of arable land was sown with wheat and 51% with corn (*SRS Statistical Yearbook*, 1997). From the total used agricultural land in the Statistical Yearbooks of Serbia, data are kept on agricultural areas, production and yields of grain (corn, wheat), sugar beet, oil seed plants (sunflower, soybean, oilseed rape), vegetables (potatoes, beans, cabbage, kale, bell peppers, tomatoes) fodder plants (alfalfa, clover, pastures, meadows) and fruit (apples, plums, cherries, raspberries, grapes, strawberries).

### Food production in the 21<sup>st</sup> century

The data presented above indicate that the basic goal, i.e., the food security of the country in terms of supply of bread grain (wheat, above all) oilseeds (sunflower, soybean) and sugar beet was ensured towards the 1980s. On the other hand, corn and by-products of soybean, sunflower, barley, wheat and sugar beet were used to feed livestock. A significant part of corn, wheat, and other field crops and their products was intended for export (*Baltić and Marković*, 2017).

From the end of the Second World War until the 1990s, meat production in Serbia constantly grew. In the 1990s, total meat production in Serbia amounted to 626,000 tons (155,000 tons of beef, 291,000 tons of pork, 32,000 tons of sheep meat, 113,000 tons of poultry and 35,000 tons of offal). In the total production in 1990, pork constituted 46.5%, beef made up nearly one quarter, poultry 18.0%, sheep meat 5.0% and offal 5.6% (*Statistical Yearbook of the SRS*, 1991). However, by 2006, total meat production had fallen to 459,000 tonnes. Over that time, the production of beef decreased by 42%, pork by 13%, sheep by 34% and poultry by 42%. Overall, meat production has decreased by 27% since 1990 (*Statistical Yearbook of RS*, 2007). The average annual total meat production for a three-year period (2018–2020)

was 518,000 tons, of which an average of 74,000 tons was beef (14.28%), pork averaged 300,000 tons (57.91%), sheep meat 32,330 tons (6.24%) and poultry 111,660 tons (21.56%) (*Statistical Yearbook of RS*, 2021). From these data, it can be concluded that meat production has stagnated, because poultry production has fallen since the 1990s. However, the most worrying decline is in beef production. Beef meat is the most sought after on the world and European Union (EU) markets, and Serbia has been exporting ever decreasing amounts in recent years. The Serbian market is supplied annually (average 2018–2020) with 2,187 tons of fish, of which 777 tons of fish originate from aquaculture and 141 tons are from open waters. During 2018–2020, the average annual production was 14,990,000 litres of milk, 17,590,000 million eggs and 826 tons of honey (*Statistical Yearbook of RS*, 2021). In Serbia, the 19<sup>th</sup> and the beginning of the 20<sup>th</sup> centuries will be remembered for the export of pigs (mainly to Austria-Hungary). The 20<sup>th</sup> century, and especially since the 1960s, will be remembered for the export of beef to Greece, Italy, Great Britain and Arab countries and pork products (canned ham), to Germany and other European countries, as well as the United States.

The disintegration of Yugoslavia, wars and sanctions put the agricultural production of Serbia in a difficult position. Today, the export of grain (corn and wheat) dominates in Serbia, while the export of livestock products dominates in more developed countries. Production capacities in crop production, and especially in livestock production, were reduced in the last decade of the 20<sup>th</sup> century. Livestock production accounts for 25% of the total agricultural production in Serbia, but over 50% in EU countries. Surplus corn is exported, even if it would be more economically justifiable to use for cattle feed, especially for beef production, so that Serbia could have enough beef for export. Data on the global production of meat and grain (corn and wheat) in 2011 show an anticipated increase in production will be needed until 2030 and 2050, respectively, when the world population should be around eight to nine billion. World meat production in 2011 was 269 million tons. The needs in 2030 will be 388 million tons (1.44-fold increase), and in 2050, 460 million tons (1.71-fold increase). Corn and wheat production in 2011 was 1.585 million tons, of which 952 million tons (60%) were intended for human consumption and 635 million tons (40%) for animal nutrition. In 2050, the total production needs will be increased 1.52-fold, animal nutrition needs by 1.71-fold, and human nutrition needs by 1.39-fold. The average

annual consumption of meat per capita in the world in 2011 was 39 kg, and ranged from 3 kg in Bangladesh and India to 116 kg in the United States. From 2000 to 2011, meat production increased 1.3-fold (Alexandratos and Bruinsma, 2012).

### Sustainable development and organic production

Organic production is a part of agricultural production based on ecological principles of sustainable development. It includes primary food production, food processing and distribution. According to projections, food security and organic production could be achieved by 2050, but arable land would have to increase by 16% to 30%, depending on climate change. If climate change were more expressed, the increase in arable land would have to be greater. However, organic production would not significantly affect the consumption of irrigation water and or the emission of damaging gases. Organic production would increase deforestation and increase soil erosion, but would reduce energy consumption, drastically reduce the amount of pesticides and nitrogen in the environment (water, soil), and would reduce the quantity of livestock and meat produced. Projections to increase the production of organic food differed from country to country. It is being considered from the angle of a complete transition to organic production, to systems in which part of conventional production (say, 20 or 50%) would be replaced by organic production. In all cases, the advantage of the more nutritionally valuable food provided by organic production is emphasized.

With 7–8 million inhabitants, Serbia could produce food for 40 million people with better use of its already available arable land, enlargement of agricultural land holdings, application of modern biotechnical measures, irrigation etc. (Baltić and Marković, 2017). Today, 424,000 hectares (12.5%) of arable land are uncultivated in Serbia, which is more than the average area under pastures or fodders, i.e. meadows, clover, alfalfa, plus soybean and sunflower. Only the areas under wheat and corn are larger than the area of uncultivated but available arable land in Serbia (Statistical Yearbook of RS, 2021). If the uncultivated areas were used as meadows with an average yield of two tons per hectare, 848,000 tons of quality fodder plants for livestock feed would be obtained. These lands are mostly uncultivated pastures and abandoned orchards overgrown with weeds. These uncultivated areas could be converted very quickly into organic production because they have not been used for years, and they are not par-

ticularly burdened with environmental or agrochemical pollutants. This measure would increase the area in organic production in Serbia by 50- to 60-fold.

Food security encompasses availability (accessibility to the population), accessibility (depends on purchasing power), stability (possibility of procurement at any time), energy, nutritional value, meeting water needs in production (especially irrigation water), land degradation, climate change, plant and animal diseases, political relations (sanctions, wars), population growth, energy consumption (for land cultivation and application of agro-technical measures), homogenization of consumption (excessive consumption of the same type of food), price formation (supply and demand) and reducing the amount of food wasted (Pérez-Escamilla and Segall-Corrêa, 2008; Maxwell, 1996; Godfray et al., 2010). International organizations such as the United Nations (UN), the Food and Agriculture Organization (FAO), the World Health Organization (WHO) and the World Organization for Animal Health (OIE) consider and promote food security, wise food consumption and food needs for the entire world population (Baltić and Marković, 2017).

Today, plant production is largely based on advances in molecular genetics, genetic engineering techniques and the creation of genetically modified varieties of corn, soybean, rice and other plant species to have other improved characteristics in addition to high yields (disease resistance, tolerance to high temperatures etc.) Genetically modified plant species are grown in the United States, Canada, China, Japan and some African, South American and EU countries. The cultivation of GMO plants is still not allowed in Serbia, but these plants are at our gates. Discussions among scientists about the harmfulness of GMOs to human health are numerous and very often contradictory (Basu et al., 2010; Taheripour et al., 2016; Hilbeck, 2015).

### New possibilities in food security and production

Today, in the world, the development of alternative food sources using other means apart from traditional agriculture is underway. This primarily refers to *in vitro* meat production. Research in this field has intensified in recent years and is attracting the attention of a growing number of scientists (Baltić et al., 2013). The use of insects as animal feed and human food is also under development. Also, microengineering has been used to cultivate algae that are rich in proteins and unsaturated fat-

ty acids. At the end of the production process, a fine, edible, green powder was obtained that could provide significant amounts of protein for human consumption (Specht et al., 2017).

Today, there is increasing concern about the world-wide problem of food waste, which significantly contributes to food insecurity. Overall, 1/3 of food produced is not used, i.e., it is discarded. In the cereal production chain, 20% is lost during harvesting and sorting, 3% during delivery and storage, 2% during processing, 9% in wholesale and retail and 19% in households. According to FAO data, 1.3 billion tons of food are thrown away in the world every year, which is enough to supply food to the world's malnourished population. Losses in the food production chain can be reduced, depending on numerous factors, such as appropriate mechanization, better training of workers, protection against pests, and proper storage conditions. In recent years, there has been a focus on the unnecessary discarding of food, especially in households. Most often, bread and fruits are discarded, while there is less squandering of meat and meat products. In Serbia every year, about 250,000 tons of food are thrown away. Everywhere in the world, including in Serbia, food waste is most common in urban areas. In rural areas, unused food is very often used for animal feed, particularly for pigs and poultry (Janjić et al., 2019).

## Conclusion

All periods in the development of Serbia, from the Slavs' arrival on the Balkan Peninsula until today, have ensured the food security of the population with appropriate local agricultural production. There were famine years during early wars, during the rule by the Ottoman Empire and during natural disasters too, but not the mass starvation and deaths that have been recorded, and unfortunately, still exist in other parts of the world. However, since the 1990s, when Yugoslavia disintegrated and Serbia experienced its latest wars and sanctions, there has been a crisis in agricultural production. The reasons for the crisis are numerous and complex. Our intention is not to discuss them in detail in this paper, because it is the concern of experts from different fields, knowledge profiles, experiences, views and opinions. Certainly, Serbia can produce far more food than it needs, just as it can certainly throw away (lose) less in the entire chain of food production, trade and distribution. Serbia could significantly increase its production of organic food and be an example in supporting the concept of corporate social responsibility and the concept of sustainable development. We should get to know our country from the past from numerous documents and relevant testimonies written by historians and travel writers. How would Cvijić, Kanic, Jiriček, Pirh, Lamartin and Čelebi describe today's Serbia?

# Proizvodnja i sigurnosti hrane na području Srbije: istorijski kontekst i sadašnji trenutak

Vesna Dorđević, Milorad Mirilović, Nenad Katanić, Jelena Janjić, Drago Nedić, Danijela Šarčević, Baltić Ž. Milan

*A p s t a r k t:* Cilj rada je da ukaže na značaj izvora i proizvodnje hrane od vremena kada je čovek postao sakupljač plodova i lovac, zatim i poljoprivrednik, sve do današnjeg vremena kada se sve više govori o sigurnosti hrane — „food security” sa aspekta obezbeđenja dovoljnih količina hrane za sadašnje i buduće generacije. U radu je predstavljena proizvodnja hrane u Srbiji od dolaska slovenskih plemena na Balkansko poluostrvo do savremenog doba, sa ciljem da se ukaže na istorijski razvoj proizvodnje hrane i neopodnost društveno odgovornog ponašanja kako bi se sačuvali resursi koje imamo za buduće generacije.

**Ključne reči:** Srbija, hrana, poljoprivreda, prošlost, budućnost.

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