

PRODUCTIVE TRAITS OF MORAVKA BREED - HAS ANYTHING CHANGED IN LAST SIXTY YEARS?

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Review paper

Abstract: The main objective of this paper is to present characteristics of autochthonous pig breed Moravka, reared in the previous century, as well as results of investigations of production performance in the last ten years. A collection of available literature data on reproductive, growth, carcass and meat quality traits of Moravka breed was carried out. According to research studies done in the 50-ies of the last century, Moravka females reached sexual maturity at about 5-6 month, whereas breeding maturity was at age of 10-12 months. Average litter size (different parities) was 6.8-8.2 born alive piglets (1.2 kg birth weight). Lactation lasted around 60 days. At weaning piglets weighed 8.7-10.4 kg (i.e. 120-150 g daily gain). Recent studies show that in average the age at first farrowing was 373±10 days, litter size 8.6±1.7 born piglets, and duration of lactation 46.8±3.4 days. Regarding growing/fattening results, only one of old studies reported daily gain in growing phase which was in average 186-197 g (depending of sex), whereas depending on type of feeding and season daily gain for fattening phase was reported between 490 and 660 g (for pigs on feed mixture and intake between 2.5 to 3.2 kg). Reported feed conversion ratio was from 4.4 to 5.1 kg/kg feed mixtures. A more recent research reported piglets to have 31.9 kg at 192 days denoting a growth rate of about 160 g/day in growing phase, whereas pigs fattened from 32 to 94 kg with maize grew 385 g/day (reported feed conversion ratio was 3.74). Backfat thickness (average of measurements along split line) was app. 7 cm (from about 4 to 9 cm) in earlier and app. 4 cm (from about 3 to 6 cm) in recent studies, but it must be noted that slaughter weight was considerably lower in recent studies. The newest research on *Longissimus dorsi muscle* showed intramuscular fat content of 7.0±0.6%, 21.5±0.2% of proteins with the specific quality traits (pH⁴⁵=6.53±0.13, pH²⁴=5.65±0.05; CIE L*=48.9±1.4, a*=12.0±1.0, b*=5.9±0.4).

Key words: autochthonous breed, reproductive traits, growth, carcass and meat quality

Introduction

Moravka was created at the beginning of the XX century, in the area around the Velika Morava River Basin. In order to improve the production characteristics of Šumadinka, the allochthonous breeds Berkshire and Yorkshire have been imported, for which there are no relevant data, as well as English Large black pig. *Belić (1951)* states that for Moravka breed, it can be said to have been accidentally created, unplanned. It is reared in the municipalities of Despotovac, Ub, Ljig, Mionica, Mladenovac, Topola, Prokuplje and Kuršumljija.

The size of the Moravka population has decreased in recent years (Table 1). There is no official breeder register. The number of animals under productivity control is insignificant, which is a limiting factor for improving the existing situation. In recent years, efforts have been made to improve the situation, which in large part has been contributed to through the financial support of the competent ministry.

Table 1. Population size

Year	1993	2004	2008	2009	2012	2013	2014	2014*	2015*
Population	1000-1500	50-1000	50-1000	100-500	150-500	100-500	100-500		
N° sows		30	45	90	140	14 (13 [#])	18 (18 [#])	12	12
N° boars		5	5	10	10	2	4	4	4
N° farms						3	5		

Source of data-DAD-FAO (www.dad.fao.org) access 29/06/2016

[#]Registered animals in Herd book.

*Source of data of Institute for Animal Husbandry (*Main Breeding Organisation*), Annual Report (2014, 2015)-animals under the control of productivity.

Petrović et al. (2007a) indicate that the Moravka has a body covered with thick or rare black hair, which is smooth and straight. On the lower parts of the body the hair is scarce, and on the other rough and longer. The skin is relatively thin and black pigmented. The head is long, narrow, with a slightly clenched profile. Cheeks are not so clearly covered with muscle tissue. The ears are big, crushed, battered. The neck is of medium length and often narrow. The body is rather long, often narrow, so that the animals appear flat. Animals reared in the intensive system have well-defined exterior widths. The backline is slightly protruding or straight. The loin is quite long, but always down. There are 4-6 pairs

of teats on the abdomen. The extremities are medium long, thin, gentle and slightly covered with muscle tissue.

Moravka has a good adaptive ability, it is distinguished by vitality and resistance to illness. It tolerates well extensive conditions of holding, so it can be successfully grown outdoors with the addition of smaller quantities of grain feeds. Today, autochthonous pig breeds are reared in open system or farm conditions and fed the traditional way or using complete mixtures (*Petrović et al., 2012*).

Consumer interest in products from Moravka pig breed is on the increase due to the specific quality of meat and meat products.

Knowing the production performance of Moravka can significantly contribute to the advancement of this breed. Therefore, the aim of this paper is to present the most important properties of fertility, growth, quality of carcasses and meat, as well as changes that have occurred in the last sixty years of the existence of this breed.

Reproductive performance

The Moravka gilts reach full maturity at the age of 5-6 months, however, the breeding maturity is reached at the age of 10-12 months (*Petrović et al., 2007a*).

Regardless of the fact that this is an autochthonous breed, the number of litters per sow annually is 1-1.5, indicating a low annual productivity of sows (Table 2). It is probable that the potential of this breed is not fully exploited and that the improvement of the rearing system the annual productivity can be improved.

Table 2. Reproductive traits of Moravka

Reference	<i>Živković and Kostić (1952b)</i>	<i>Lalević et al. (1953)</i>	<i>Petrović et al. (2007a)</i>	<i>Faculty of Agriculture (2009)</i>	<i>Institute for Animal Husbandry (2014)</i>
Reproductive traits					
Number of sows recorded	98	24	-	16	12
Sow age/parity ¹	> 2 years	1.5 [*] /2.5 ^{**} /4 ^{***} years of age		2.3±1.2 parities	373±10 (age at first farrowing)
Litters/sow and year				1.06	1-1.5
Piglets/litter	8.6±2.3 (4-16)				8.6±1.7
Piglets alive/litter	7.8±2.1 (4-13)		7.2±2.0 (5-14)	6.8±1.6 (3-9)	8.2±2.1
Piglet live birth weight (kg)	1.2				
Piglets weaned/litter	6.8±2.2 (2-12)				8.1±2.0
Piglet weaning weight (kg)	10.04				
Duration of lactation (days)	60	60			46.8±3.4
Average daily milk production (kg) measuring of litter weight before and after suck		2.2 [*] (1.9-2.4) 2.3 ^{**} (2.00-2.5) 2.3 ^{***} (2.00-2.5)			

¹* 1st farrowing, **^{2nd} farrowing, ***^{3rd} farrowing; Average value in the table (Mean±SD)

The number of piglets born in the litter varies by age (*Lalević, 1954*), as well as by the seasons (*Lalević, 1953*). The average litter size is 8.6 piglets, and the number of live-born piglets ranges from 6.8 to 8.2 (Table 2). When it comes to the size of the litter, there are no significant differences between previous and recent researches, which shows that Moravka has retained its reproductive potential. If the variation intervals are analyzed, the number of live-born piglets in the litter ranges from 3 to 14, indicating that this breed possesses fertility potential and that systemic selection can improve this trait.

Sows of autochthonous breeds have a well-defined maternal instinct, so the piglet losses in the suckling period are lower compared to allochthonous genotypes. The number of weaned piglets ranges from 6.8 to 8.1, and by comparison with the number of live piglets at birth, losses are 1.2-12.8%.

The average milk production of sows of different ages during lactation was 133.74 kg (*Lalević, 1953*). The lowest production of milk is found in the primiparous sows, while the highest is in multiparous sows. The same author points out that the yield of milk varies between sows of the same age during whole lactation, but also during the lactation decades, where the milk yield increases from the first to the fourth lactation decade (sows aged 4 years) and then decreases.

Research of *Petrović et al. (2007a)* reports that at weaning, at the age of 60 days, the average body weight of piglets is from 8.7 to 10.4 kg with differences relating to different methods of rearing during suckling period (i.e., 120-150 g daily gain). Recent data show that the age of primiparous sows is 373 days, while the suckling period is shorter compared to the earlier period. Shortening of the suckling period is probably a consequence of providing better conditions for rearing of weaned piglets.

The demonstrated variability of litter size traits, indicates the potential of this breed, but also the need for continuous productivity control and selection. In addition to improving the properties, it is necessary to define the most optimal system of rearing in order to make the breeding of this pig breed more sustainable over a longer period of time.

Growth traits

Moravka is an autochthonous breed of combined production capabilities. Table 3 shows the production traits of Moravka, which indicate differences depending on the intensity of the rearing, nutrition, gender, season and fattening system.

In the experiment, *Živković and Kostić (1952a)*, examined 25 animals with a balanced gender ratio and found the following results: in the first group with pre-slaughter body weight (BW) of 115 kg, average daily increase was 0.490 kg, while in the other group, at BW of 137 kg, ADG was 0.660 kg. The addition of protein feeds (soybean) into the diet had stimulating effect on the daily increase of pigs, which reflected on higher average daily intake and better utilization of food.

By comparing winter and summer fattening, *Mitrović and Kostić (1954)* have found a better growth during summer fattening, which may indicate that females of this breed better tolerate high summer temperatures, compared to the winter period when a large part of energy is spent on maintaining body temperature. During the lactation period, *Živković and Kostić (1952b)* have found an absolute gain of piglets of 8.8 kg (10-1.2), which indicates that the average daily gain in this period is about 150 g/day. During the growth phase, the same

researchers have determined an average daily gain of 186-197 g, with higher gain observed in male piglets.

Research of *Petrović et al. (2007a)* reported that piglets to have 31.9 kg at 192 days denoting a growth rate of about 160 g/day in growing phase, whereas pigs fattened from 32 to 94 kg with maize grew 385 g/day (reported feed conversion ratio was 3.74).

By comparing earlier results with the recent research of *Radović et al. (2017)*, it is evident that the growth of fatteners of this breed has decreased (369 g/day). This decline in the growth rate is probably the result of fewer numbers of the population today, in-breeding and lack of selection procedures with aim to improve the growth traits.

Presented production performances show the potential of this breed, the need to increase the population, improve the system of rearing and to implement selection.

Table 3. Variability of growth traits

Reference	<i>Živković and Kostić (1952a)</i>		<i>Mitrović and Kostić (1954)</i>		<i>Živković and Kostić (1952b)</i>	<i>Radović et al. (2017)</i>
	Group feeding only with corn	Group feeding with 85% corn+15% soya	Winter fattening; concentrated mixture (85% corn+15% sunflower expeller)	Summer fattening; concentrated mixture (85% corn+15% sunflower expeller)	-	Semi-intensive system
Growth traits						
Body weight (BW) at slaughter, kg	115 (83.5-151)	137 (110-174)	134 (118-154)	137 (110-174)	149.8 (121-214);	134.8
BW in the trial, kg	55-115	58-137	61-134	56-137	1.2-10.0 (lactation-60 days); ♂10.9-34.6 ♀10.4-32.7	30-150
Average daily gain (ADG), kg	0.490	0.660	0.600	0.660	♂ 0.197 ♀ 0.186	0.369
Average feed intake (ADFI), kg	2.45	2.99	3.16	-	-	-
Feed conversion ratio (FCR), kg/kg	4.95	4.44	5.13	-	-	-

Carcass and meat quality traits

The carcass side quality traits vary depending on the diet and the rearing system (Table 4). Depending on the period when the research was conducted, the differences in the body weight of pigs at slaughter are also evident. The slaughter weight was different and ranged from about 101 to 150 kg in a number of authors. In the earlier period, pigs were fattened to large body masses, which affected the higher content of fat tissue in the carcass. Today consumers' demands are focused on the leanness of the carcass sides, which caused pigs to be fattened to lower weights, similar to those in the intensive breeding system (about 100-110 kg). The slaughter yield ranged from 76 to 83%. The thickness of the fat tissue varied in the presented researches depending on the pre-slaughter body weight of pigs and the location on the carcass on which it was measured.

Table 4. Carcass performance of Moravka

Reference					
	<i>Živković and Kostić (1952a)</i>	<i>Živković and Kostić (1952b)</i>	<i>Mitrović and Kostić (1954)</i>	<i>Petrović et al. (2007b)</i>	<i>Petrović et al. (2010)</i>
Carcass traits					
Feeding/Production system	Feeding with 85% corn+15% soya)	Concentrated feeding	Concentrated mixture (85% corn+15% sunflower expeller	Semi-intensive	Semi-intensive
Slaughter weight (kg)	145.33	149.80	131.57		101.22
Carcass weight (kg)	109.79	117.10	101.14		84.15
Carcass yield (% live weight)	75.54	78.17	76.88		83.00
Carcass length (os pubis-atlas, os pubis-1 st rib; cm)				106.4±0.9 86.6±0.9	95.5 77.8
Backfat thickness (cm)	neck	6.08	6.20	6.08	6.32
	ridge	9.00	9.37	9.07	
	loins	8.41	8.15	7.73	
	rump	7.50	8.32	6.89	
	belly	5.08	3.73	4.42	

The lowest weight of the carcass side (84.15 kg) is recorded in the research by *Petrović et al. (2010)*, but with the highest carcass side yield 83%. The length of the carcass side was 95.5 cm (*os pubis-atlas*) and 77.8 cm (*os pubis-1 rib*) in the

research by *Petrović et al. (2010)* to 106.4 cm (*os pubis-atlas*) and 86.6 cm (*os pubis-1 rib*) in the research of *Petrović et al. (2007b)*.

According to the research of *Petrović et al. (2010)*, the weight of the round was 8.19 kg (3.55 kg of muscle tissue), the weight of the shoulder was 4.35 kg (1.90 muscle tissue) and the weight of the back-loin part 6.95 kg (2.09 kg muscle tissue). The weight of fat tissue and lard was 60.53 kg (*Mitrović and Kostić, 1954*) with a share of fat tissue of 59.85%; 69.79 kg (*Živković and Kostić, 1952a*) with the share of fat tissue of 63.57 kg and 76.50 kg (*Živković and Kostić, 1952b*) with the share of fat tissue of 65.33 kg. Muscle bone mass varied from 38.45 kg (*Živković and Kostić, 1952b*) to 40.61 kg (*Mitrović and Kostić, 1954*). The proportion of bones with muscle in the carcass side ranged from 32.84% (*Živković and Kostić, 1952b*) to 40.15% (*Mitrović and Kostić, 1954*). In the research *Živković and Kostić (1952a)*, the bone mass with muscles is 40 kg, while their share in the carcass side is 36.43%.

The newest research (*Radović et al., 2017*) on *Longissimus dorsi* muscle shows intramuscular fat content of $7.0\pm 0.6\%$, $21.5\pm 0.2\%$ of proteins with the specific quality traits ($\text{pH}^{45}=6.53\pm 0.13$, $\text{pH}^{24}=5.65\pm 0.05$; CIE $L^*=48.9\pm 1.4$, $a^*=12.0\pm 1.0$, $b^*=5.9\pm 0.4$). Research of *Petrović et al. (2014)* shows the specific fatty acid composition of the long back muscle ($\Sigma\text{SFA}=41.6\pm 0.6\%$, $\Sigma\text{MUFA}=53.8\pm 0.6\%$, $\Sigma\text{PUFA}=4.5\pm 0.3\%$).

Given the high heritability of slaughter traits, the improvement of this breed in terms of carcass quality is possible. The lower performances of the carcass side quality of this breed compared to allochthonous genotypes largely is compensated by the meat quality traits.

Conclusion

Knowing the production performance of Moravka can significantly contribute to the advancement of this breed. The observed variability of production characteristics indicates that the potential of this breed exists. The lower phenotypic value of some properties, in comparison with the previous period, is probably due to the decline in the number of animals in the population of this breed of pigs, which indicates the need to increase the population, to continuously control productivity, to improve the system of keeping and implement the systematic selection.

Proizvodne osobine moravke - da li se nešto promenilo u poslednjih šezdeset godina?

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Rezime

Glavni cilj ovog rada je prikaz proizvodnih osobina autohtone rase svinja moravka, gajene u prethodnom veku, kao i rezultata istraživanja u poslednjih deset godina. Sprovedeno je prikupljanje dostupnih literaturnih podataka osobina plodnosti, porasta, kvaliteta trupa i mesa. U skladu sa istraživanjima sprovedenim 50-tih godina prošlog veka, plotkinje moravke postižu polnu zrelost sa oko 5-6 meseci, a priplodnu zrelost u uzrastu 10-12 meseci. Prosečna veličina legla (različiti pariteti) je 6,8-8,2 živorođene prasadi (1,2 kg masa na rođenju). Laktacija je trajala oko 60 dana. Telesna masa prasadi na zalučenju bila je 8,7-10,4 kg (120-150 g dnevni prirast). Skorašnja istraživanja pokazuju da je uzrast prvopraskinja 373 ± 10 dana, veličina legla $8,6 \pm 1,7$ rođene prasadi i trajanje laktacije $46,8 \pm 3,4$ dana. U pogledu rezultata porasta/tova, samo jedna starija studija pokazuje dnevni prirast u fazi porasta od prosečno 186-197 g (zavisno od pola), dok je u zavisnosti od tipa ishrane i sezone, dnevni prirast u fazi tova bio između 490 i 660 g (za svinje hranjene krmnim smešama i dnevnom unosu hrane od 2,5 do 3,2 kg). Utvrđena konverzija hrane bila je od 4,4 do 5,1 kg/kg krmne smeše. Novija istraživanja su pokazala da prasad imaju 31,9 kg pri 192 dana uzrasta, što znači da su ostvarila stopu porasta od 160g/danu u fazi porasta, dok su svinje tovljene od 32 do 94 kg sa kukuruzom prirastale 385 g/danu (konverzija hrane bila je 3,74). Debljina slanine (prosečne mere) je bila oko 7 cm (od oko 4 do 9 cm) u ranijim i oko 4 cm (od oko 3 do 6 cm) u novijim istraživanjima, s tim da je telesna masa pri klanju znatno niža u novijim studijama. Novija istraživanja mišića *Longissimus dorsi muscle* pokazala su sadržaj intramuskularne masti od $7,0 \pm 0,6\%$, sadržaj proteina od $21,5 \pm 0,2\%$ sa specifičnim kvalitativnim osobinama ($\text{pH}^{45} = 6,53 \pm 0,13$; $\text{pH}^{24} = 5,65 \pm 0,05$; CIE $L^* = 48,9 \pm 1,4$; $a^* = 12,0 \pm 1,0$; $b^* = 5,9 \pm 0,4$).

Ključne reči: autohtona rasa, reproduktivne osobine, porast, kvalitet polutki i mesa

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