Original Article

Quantitative-genetic analysis of growth intensity of autochthonous breeds Mangalitsa pigs reared in traditional and modern systems

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Abstract

The aim of this study was to analyse growth intensity of Mangalitsa pig breed reared in two different systems, traditional and modern (intensive), which provides basic indicators of the economy of the rearing of this pig breed. The study included 13 litters (78 pigs) of Mangalitsa reared in the traditional system (MTS) and 13 litters (98 pigs) reared in the modern system (MMS). In the rearing phase there were 60 MTS piglets and 90 MMS piglets, and in the fattening phase 53 MTS pigs and 71 MMS pigs. Genetic parameters were estimated using the restricted maximum likelihood (REML) procedure based on an animal model with multivariate analyses. Results indicated a significant advantage of growth intensity in certain phases of rearing MMS in relation to MTS. Compared to the MTS piglets, the MMS piglets achieved 2.18 kg higher body weight at suckling and 7.02 kg higher body weight at the end of rearing, and fattening was 56 days shorter. At the end of fattening, the MMS fatlings at age of 255 days achieved body weight of 96.50 kg, while the MTS fatlings at age of 311 days achieved average body weight of 93.04 kg. All traits of growth intensity recorded had medium to high degree of heritability: for WB 0.226, for WW 0.328, for ADGS 0.501, for WR 0.673, for ADGR 0.492, for WF 0.703, for ADGF 0.373, for WEF 0.614 and for ADGL 0.495. Based on the obtained results in this study it is concluded that for survival, genetic improvement, and affirmation of existing resources, it is necessary to apply modern technologies in the breeding and rearing of the Mangalitsa breed, as well as to review the selection criteria and the parameters of genetic progress, in order to increase survival rate, competitiveness and further expand the market.

Keywords: Mangalitsa, growth intensity, traditional and modern systems, heritability

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Introduction

In Serbia there are three local autochthonous breeds of pig: Mangalitsa, Moravka and Resavka. Mangalitsa was created by crossing Sumadia, the lost autochthonous Serbian breed, with Szalontai and Bakonyi, the Hungarian autochthonous breeds. Mangalitsa is a lard production type of pig which characterizes late sexual maturity, low fertility, large feed consumption per unit of gain, marked tendency for fat production, and strong constitution, as well as great adaptive capacity for poor condition, nutrition and rearing. Due to its exceptional modesty and resistance, Mangalitsa was very popular in Serbia (especially in Vojvodina) and Hungary in the period from the XIX century until the fifties of last century. In the beginning of the creation there were five varieties of this breed but only three managed to survive: Blonde, Red and Swallow-Bellied, confirmed by genetic analysis (Zsolnai et al., 2006). In Serbia there are three strains of Mangalitsa: Sremska Black, White and Subotica (Gajić et al., 1997).

In modern conventional livestock production mainly highly productive breeds of pig and their hybrids are used. The result is that today, in order to achieve the greatest possible profits, breeding relatively small number of primitive breeds, including Mangalitsa, is widely done. However, the industrial production of pigs caused rapid decline in the local pig population throughout the world, especially in Europe (Rátky et al., 2008). As a result, many breeds of pig are irretrievably lost, while some are close to extinction such as Spanish Iberian, Italian Cinta Senese, French Basque, Portuguese Alentejano, Croatian Black Slavonian, Serbian and Hungarian Mangalitsa. These pig breeds have good characteristics of being adaptable to the climate, suitable outdoors and on pastures, while their meat is of special quality and enables the production of long-lasting cured meat products. Raising these breeds will also support organic animal production and open up their feasiblity (Katić et al., 2010).

Today, meat production in Serbia and throughout the world is based on the application of modern methods of breeding specialized breeds of pigs and their hybrids, in order to obtain greater share of muscle tissue in the carcass of adequate quality. Thus, obtained fatlings for slaughter have over 55% of meat in the carcass (Lukač et al., 2013; Polkrabek et al., 2006; Latorre et al., 2004), in contrast to Mangalitsa whose carcass contains average of 65-70% fat and 30-35% meat (Lukač et al., 2014; Rátky et al., 2013; Šević et al., 2012; Egerszegi et al., 2003), which is sufficient for the production of high-quality hams and other products.

Moreover, there has recently been some interest in autochthonous breeds not only to preserve the genes, but also for the production of meat products produced in the traditional method (Parunović et al., 2012; Butko et al., 2007; Pugliese et al., 2003). The meat of Mangalitsa can serve as raw material for the production of specific products which may obtain the mark of the protected geographic origin (Šević et al., 2012). The development and production of traditional products with protected geographical origin provide better recognition and positioning in the market and higher profits (Zekić et al., 2013).

Despite relatively small investment, the Mangalitsa breed has very low productivity and consequently requires additional costs for feed. This research determined the parameters of growth intensity in both traditional and modern systems of breeding Mangalitsa, in order to achieve positive financial effects and possibility of improving the Mangalitsa genetic potential through the development of specific breeding programs for better production results throughout its generations in the future.

Materials and Methods

Animals and studied traits: The research was conducted on a commercial pig farm in Serbia that produces pure-bred pigs and their hybrids, and engages in the production of the autochthonous pig breed, Mangalitsa. The experiment included 13 litters of Mangalitsa originating from two boars, white variety, reared in the traditional system (MTS) and 13 litters originating from 4 boars reared in the modern system (MMS). The number of animals per phases of breeding is shown in Table 1.

Table 1 Number of animals per phases of breeding

Number of piglets	MTS	MMS
Total born	81	99
Born alive	78	98
Stillborn	14	5
Weaned	64	93
Rearing	60	90
Fattening	53	71

MTS - traditional system; MMS - modern system

Analysed by the following traits of intensity growth: weight at birth (WB), weight at weaning (WW), average daily gain at suckling (ADGS), weight at rearing (WR), average daily gain at rearing (ADGR), weight at fattening (WF), average daily gain at fattening (ADGF), weight at the end of fattening (WEF) and average daily gain of life (ADGL).

Management: The Mangalitsa sows reared in the modern system (MMS) mated with pure-bred boars of the same breed naturally, while the Mangalitsa sows reared in the traditional system (MTS) also had natural mating, harem mating. After insemination, pregnant MTS sows were out on pastures, in a group of 10. For pregnant MMS sows, insemination was conducted on the next 28 days in individual boxes and after 28 days

of gestation they were moved to group boxes measuring 7 x 6 m. The settling of sows in the objects for farrowing was 5 days before the expected farrowing date. The MMS sows were housed in farrowing boxes, while the MTS sows were housed in farrowing boxes with dimension of 2.5 x 2.0 m, with full concrete ground and straw. The farrowing sows in both groups were fed on feed for lactating sows (18% protein, 1% lysine, 13.80 MJ/kg ME) three times a day. MMS piglets were fed on prestarter starting from the seventh day of age, while MTS piglets together with their mothers took food that were fed on the ground.

All piglets at farrowing and weaning were measured, after which daily gain was established and averaged. After weaning, the piglets were placed in rearing, and nutrients were provided at will with concentrated feed according to the standards for modern breeds of pig. The MTS piglets were housed in group boxes with full concrete ground and straw, and nutrients were provided at will. At the stage of rearing, every week body weight of the piglets in both groups was measured. After the phase of rearing, all the pigs were transferred to fattening where they stayed until leaving for slaughter. Ground in the fattening for the MMS pigs was concrete, and nutrients were provided at will according to the food standards for modern breeds of pig. The MTS fatlings were housed in a large pasture where they moved freely. On one part of the pasture was a marquee where the pig sheltered from rain and sun.

The nutrients were provided with concentrate type finisher with addition of corn, a clover, seasonal fruit, vegetables and the like. All fatlings were measured at specific intervals. Daily and life gain and age of fatlings at the end of fattening were calculated.

Statistical and Genetic analyses: Effect of the rearing system was tested by ANOVA in software package Statistica 12. Experimental data were also statistically processed and analysed by the software package. Significance of the fixed effects and inclusion in the models were determined for each trait using the ANOVA (Table 1.). To estimate genetic parameters of the model a formula was constructed as follows:

$$Y_{ijklm} = \mu + A_i + O_j + S_k + G_l + b_1(X - \bar{X}) + e_{ijklm}$$

Variance components and genetic parameters of the model were obtained by the restricted maximum likelihood method (REML) using the statistical program WOMBAT developed by Meyer (2007). The model was represented in matrix terms by

$$y = Xb + Za + e$$

where $\boldsymbol{y}$ = vector of observations; X = incidence matrix of fixed effects; b = vector of fixed effects; Z = incidence matrix of random effects; a = vector of random effects; e = vector of residuals.

Heritability were calculated by the following formulas:

$$h^2 = \sigma_a^2 / \sigma_p^2$$

$$h_e^2 = \sigma_e^2 / \sigma_p^2$$

where h^2 = direct additive heritability; h_e^2 = residual heritability.

Results

Tables 2, 3 and 4 show the means and standard deviation of body weight and daily gain throughout the stages of rearing Mangalitsa pigs in the traditional (MTS) and modern systems (MMS). The body weight (WB) at birth of the MTS piglets was 1.53 kg on average, while that of the MMS piglets was about 1.57 kg on average. At rearing and suckling at 37 days of age, the MMS piglets achieved 2.18 kg higher body weight and average daily gain (ADGS) of 58.20 g in relation to the MTS piglets. The body weight of the weaning MMS piglets (WW) was 8.22 kg, whereas that of the MTS pigs was 5.98 kg, indicating a very significant difference (P<0.01) resulting from the better conditions of feeding, care and housing of the MMS sows. The results obtained at rearing (Table 3), which lasted 50 days, showed that the MTS piglets achieved body weight (WR) of 12.51 kg on average, while the MMS piglets achieved body weight of 16.85 kg, indicating a very significant difference (P<0.01) of 4.34 kg. Moreover, the average daily gain (ADGR) was 86.89 g higher (P<0.01) in the MMS piglets compared to the MTS piglets. At the age of 87 days, the MMS piglets had body weight of 25.07 kg, while the MTS piglets had body weight of 18.49 kg, which is 5.58 kg less, indicating a very significant difference (P<0.01). The reason for this large difference in body weight was the greater initial weight at rearing, and the better conditions of nutrition, accommodation and care.

Table 2 Means and standard deviation (SD) of body weight and average daily gain at suckling

Traits	Rearing system		Differences	Significance level
	MTS	MMS		
WB, kg	1.53 ± 0.24	1.57 ± 0.27	0.04	NS
WS, kg	4.46 ± 0.83	6.64 ± 1.77	2.18	**
WW, kg	5.98 ± 0.86	8.22 ± 1.81	2.24	**
ADGS, g	121.80 ± 22.04	180.00 ± 40.01	58.20	**
DS, days	37	37	0	

WB - weight at birth; WS - weight at suckling; WW - weight at weaning; ADGS - daily gain at suckling; DS - duration of suckling; MTS - traditional system; MMS - modern system; NS - not significant; ** < 0.01

Table 3 Means and standard deviation (SD) of body weight and average daily gain at rearing

Traits	Rearing system		Differences	Significance level
	MTS	MMS		
WR, kg	12.51 ± 2.34	16.85 ± 3.60	4.34	**
WER, kg	18.38 ± 2.51	25.40 ± 4.49	7.02	**
ADGR, g	266.21 ± 49.88	353.10 ± 75.65	86.89	**
DS, days	50	50	0	
AER, days	87	87	0	

WR - weight at rearing; WER - weight at the end of rearing; ADGR - daily gain at rearing; DS - duration of rearing; AER - age at the end of rearing; MTS - traditional system; MMS - modern system; ** < 0.01

The results obtained at fattening are shown in Table 4. During the fattening phase, the MTS fatlings, whose fattening lasted 224 days, achieved average body weight (WF) of 74.55 kg and average daily gain (ADGF) of 333.27 g while the MMS fatlings, whose fattening lasted 168 days, achieved body weight (WF) of 70.93 kg and average daily gain (ADGF) of 442.21 g. The MMS fatlings spent 56 days less at fattening in relation to the MTS fatlings. At the end of fattening, the MMS fatlings at a total of 255 days of age had body weight (WEF) of 96.50 kg and average life gain (ADGL) of 374.99 g while the MTS fatlings at the age of 311 days had body weight (WEF) of 93.04 kg and average life gain (ADGL) of 297.34 g, indicating a very significant difference (P<0.01).

Tables 5, 6 and 7 show the intensity of growth of MTS and MMS at rearing and fattening by phases at the controls.

Table 4 Means and standard deviation (SD) of body weight and average daily gain at fattening

Traits	Rearing system		Differences	Significance level
	MTS	MMS		
WF, kg	74.65 ± 12.04	70.93 ± 9.28	-3.72	**
WEF, kg	93.04 ± 10.94	96.50 ± 9.75	3.46	**
ADGF, g	333.27 ± 53.76	422.21 ± 55.25	88.94	**
ADGL, g	297.34 ± 35.97	374.99 ± 38.46	77.65	**
DS, days	224	168	-56	
AER, days	311	255	-56	

WF - weight at fattening; WEF - weight at the end of fattening; ADGF - daily gain at fattening; ADGL - life gain; DS - duration of fattening; AER - age at the end of rearing; MTS - traditional system; MMS - modern system; ** < 0.01

Table 5 Means and standard deviation (SD) of growth intensity of pigs per week at rearing

Measurement	Age, days	Body weight, kg		Differences	Significance level
		MTS	MMS		
I Week	45	6.50 ± 2.21	10.00 ± 1.96	3.50	**
II Week	52	8.21 ± 2.33	12.21 ± 2.31	4.00	**
III Week	59	10.53 ± 2.87	14.94 ± 2.99	4.41	**
IV Week	66	12.62 ± 3.13	16.89 ± 3.43	4.27	**
V Week	73	14.51 ± 3.90	19.55 ± 3.85	5.04	**
VI Week	80	16.42 ± 3.82	23.10 ± 2.94	6.68	**
VII Week	87	18.38 ± 4.52	25.07 ± 4.48	6.69	**

MTS - traditional system; MMS - modern system; ** < 0.01

Residual, direct additive genetic variance components and phenotypic, residual and direct heritability with standard errors for the intensity growth of Mangalitsa breed are shown in Table 8. From Table 8 it can be seen that all traits have intensity growth of medium to high degree of heritability. The heritability of average daily gains was smaller (from 0.37 for ADGF to 0.50 for ADGS) in relation to the heritability of achieved body weight (from 0.32 for WW to 0.70 for WF) in different phases of rearing. The heritability of ADGL was lower (0.49) compared to the WEF heritability (0.61), while the heritability of WB was the lowest and was 0.22.

Table 6 Means and standard deviation (SD) of growth intensity of fatlings per phase control at fattening

Life age, days	Time spent in fattening, days	Body weight, kg		Differences	Significance level
		MTS	MMS		
87 - 94	7	19.71 ± 6.36	28.26 ±6.21	8.55	**
94 - 101	7 - 14	21.33 ± 5.63	32.17 ±4.18	10.84	**
101 - 108	14 - 21	24.09 ± 4.54	33.29 ±4.04	9.20	**
108 - 115	21 - 28	26.53 ± 4.13	35.64 ±4.42	9.11	**
115 - 143	28 - 56	34.48 ± 6.86	49.29 ±5.95	14.81	**
143 - 171	56 - 84	48.68 ± 7.55	64.90 ±6.81	16.22	**
171 - 199	84 - 112	60.39 ± 9.63	77.67 ±8.45	17.28	**
199 - 227	112 - 140	68.92 ± 8.95	88.61 ±8.87	19.69	**
227 - 255	140 - 168	78.75 ± 9.65	96.50 ±9.03	17.75	**
255 - 283	168 - 196	86.40 ± 9.98			
283 - 311	196 - 224	93.04 ± 10.03			

MTS - traditional system; MMS - modern system;** < 0.01

Table 7 Means and standard deviation (SD) of daily gains of fatlings per phase control at fattening

Life age, days	Time spent in fattening, days	Daily gain, g		Differences	Significance level
		MTS	MMS		
87 - 94	7	189.22 ± 88.59	408.08 ±258.35	218.86	**
94 - 101	7 - 14	210.24 ± 100.18	469.04 ±226.00	258.80	**
101 - 108	14 - 21	271.88 ± 169.08	366.30 ±138.03	94.42	**
108 - 115	21 - 28	290.84 ± 212.36	358.51 ±107.25	67.67	**
115 - 143	28 - 56	287.43 ± 193.18	423.07 ±94.48	135.64	**
143 - 171	56 - 84	360.62 ± 155.12	467.79 ±75.62	107.17	**
171 - 199	84 - 112	375.08 ± 131.05	464.85 ±69.32	89.77	**
199 - 227	112 - 140	360.94 ± 98.06	450.09 ±58.23	89.15	**
227 - 255	140 - 168	359.34 ± 85.67	422.21 ±50.11	62.87	**
255 - 283	168 - 196	347.00 ± 81.17			
283 - 311	196 - 224	333.27 ± 73.46			

MTS - traditional system; MMS - modern system; ** < 0.01

Table 8 Variance and heritability of intensity growth of Mangalitsa breed

Traits	V_e	V_a	V_p	h_e^2	SEh_e^2	h^2	SEh^2
WB	0.559	0.163	0.722	0.774	0.041	0.226	0.041
WW	14.147	6.908	21.055	0.672	0.050	0.328	0.050
DGS	2.481	2.494	4.975	0.499	0.018	0.501	0.018
WR	4.070	8.397	12.468	0.327	0.032	0.673	0.032
DGR	4.599	4.458	9.049	0.508	0.013	0.492	0.013
WF	22.682	53.57	76.257	0.297	0.031	0.703	0.031
DGF	58.109	34.517	92.537	0.627	0.070	0.373	0.070
WEF	31.253	49.777	81.030	0.386	0.003	0.614	0.003
LG	69.150	67.812	136.963	0.505	0.010	0.495	0.010

WB - weight at birth; WW - weight at weaning; DGS - daily gain at suckling; WR - weight at rearing; DGR - daily gain at rearing; WF - weight at fattening; DGF - daily gain at fattening; WEF - weight at the end of fattening; LG - life gain. V_e – residual variance; V_a – additive genetic variance; V_p – phenotypic variance; h_e^2 – heritability of residual variance; h^2 – heritability; SEh^2 – standard error of heritability

Figure 1 Mangalitsa reared in traditional system

Figure 2 Mangalitsa reared in modern system

Discussion

The obtained results indicate a significant advantage in the growth intensity of Mangalitsa pigs reared in the modern system compared to the traditional system. The reasons for better results of intensity growth and shorter fattening of MMS are the better conditions of nutrition, accommodation and care, which led to maximize the genetic potential of this group of pigs. Similar to our research, Hoha et al. (2012) compared the production results of Mangalitsa breeding in the modern and traditional systems. In the modern system, the piglets at 30 days of age achieved average body weight of 6.85 (5.10-7.40 kg), and at rearing which lasted 70 days 24.14 kg (21.26-27.26 kg), which gives an average daily gain at rearing of 247 g (230-283 g) with the conversion of 2.89 kg. In the traditional system, the piglets obtained body weight of 6.10 kg (4.90-7.25 kg) at weaning at 30 days of age, and 21.60 kg (19.30-25.40 kg) at rearing which lasted 70 days, which gives an average daily gain of 221 g (205-259 g) with the conversion of 3.09 kg. In the research of Brüssow (2005), Mangalitsa piglet weight at birth was 1.22 kg, at 4 weeks of age 9.94 kg, at 8 weeks of age 14.5 kg, and at 10 weeks of age 13.67 kg. In the research of Miclea et al. (2012), the average weight of piglets at birth was from 1.00 to 1.20 kg, at the age of 21 days from 5.59 to 5.98 kg, and at weaning at the age of 56 days from 12.34 to 12.80 kg. Hall et al. (2010) found average body weight of 1.10 kg at birth and 6.07 kg at weaning at 32 days. Similar results were obtained by Egerszegi et al. (2007), Miclea et al. (2005) and Rátky et al. (2001).

In the study of Hoha et al. (2012), Mangalitsa breeding was performed using an intensive system, fattening started at 100 days of age with an average weight of 24.14 kg, at 365 days of age the weight was 106.40, average daily gain was 295 g and feed conversion was 5.30 kg. In the same study, for the traditional system, fattening started at the age of 100 days with an average weight of 21.60 kg, at 365 days of age the average weight was 90.14 kg, average daily gain was 258 g and feed conversion was 6.20 kg. According to a study by Hungarian National Association of Mangalitsa Breeders, Mangalitsa is expected to gain about 10 kg per month during the period of growth. According to the same study, life gain of 100 kg of weight is found in White Mangalitsa at 311 g/day, Swallow-Bellied at 282 g/day, and Red at 323 g/day, which means that the White mangulica can achieve 100 kg body weight at the age of 327 days, the Swallow-Bellied at the age of 362 days, and the Red at the age of 311 days. On average, the life gain is 307 g/day, therefore, it takes Mangalitsa 332 days of life to achieve the weight of 100 kg. Rátky (2008) stated that to allow Mangalitsa to gain 1 kg, 4.8-5.8 kg of maize was required. According to the research of Szabó (2006), it took 235 days for Large White to achieve a weight of 130-140 kg, with an average daily gain of 725 g and average life gain of 554 g, whereas it took 329 days for a white Mangalitsa to achieve the same weight, with an average daily gain of 496 g and average life gain of 420 g. Šević et al. (2012) reported that fattening Mangalitsa and Landrace to 132 kg resulted in average life daily gain of 242 g with a conversion of 5.2 kg in Mangalitsa and 584 g with a conversion of 3.1 kg in Landrace.

Gundel et al. (2006) studied the economy of fattening Mangalitsa and found that mangulice that was given better nutrients did not produce improved fattening results, that reduction in the nutritional value of food improved its utilization, and that meat share was not influenced by nutrition. To feed Mangalitsa to 100 kg at fattening, daily gain of 459 g/day was achieved with better nutrition and 456 g/day with poorer nutrition. The conversions were 4.5 kg with better nutrition and 4.4 kg with poorer nutrition. To fatten it to 130 kg, daily gain of 419 g/day was achieved with better nutrition and 413 g/day with poorer nutrition. The conversion of both types of feeding was 5.2 kg. Zekić et al. (2012) compared the economy of production of fatling up to 132 kg in Mangalitsa and Yorkshire breeds in the intensive system and established life gain of 242 g/day, feed conversion of 5.2 kg and cost price of € 2.13/kg in Mangalitsa, and 584 g/day, 3.1 kg and 1.26 €/kg in Yorkshire, respectively.

All traits of growth intensity recorded had medium to high degree of heritability. In the research of Vidović et al. (2011), Mangalitsa had heritability of life gain to 100 kg of 0.34, of age to 132 kg 0.35 and of feed conversion 0.39, while Yorkshire had 0.32, 0.37 and 0.40, respectively. Gjerlaug-Enger et al. (2011) found heritability of ADGR 0.25 in Landrace and 0.48 in Duroc, and of ADGF 0.41 in Yorkshire and 0.42 in Duroc. Moreover, heritability of ADGF in a range of 0.27 to 0.58 was reported by Szyndler-Nedza et al. (2010) in Yorkshire (0.29), Landrace (0.39) and Duroc

(0.58) breeds; by Hoque and Suzuky (2008) in Duroc (0.38) and Landrace (0.47); by Imboonta (2007) in Landrace (0.38); and by Gilbert et al. (2007) in Yorkshire (0.35).

Due to its phenotypic and production characteristics, Mangalitsa is extremely resistant to environmental factors, with very high level in usage of natural resources, thus possessing all necessary prerequisites for meaningful economic exploitation. This is one of the main preconditions of its biological survival, despite the fact that this breed is not competitive on the conventional pork meat market. The concept of semi-intensive farming of Mangalitsa, framed by the standards of organic agriculture, with quality programs and promotion of economic evaluation, has a big chance for survival in Serbia and in the world. Rearing Mangalitsa in conditions of modern highly-selected breeds and hybrids in the system of industrial production might cause the genetic potential of this breed be better exploited.

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บทคัดย่อ

การวิเคราะห์ลักษณะทางพันธุกรรมของการเติบโตในสุกรพันธุ์ autochthonous Mangalitsa ที่เลี้ยงแบบระบบพื้นบ้านและระบบใหม่

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วัตถุประสงค์ของการศึกษาครั้งนี้เพื่อวิเคราะห์การเติบโตของสุกรพื้นเมือง Mangalitsa ที่เลี้ยงแบบระบบพื้นบ้าน (traditional system, MTS) และระบบใหม่ (modern system, MMS) ซึ่งจะใช้ตัวบ่งชี้พื้นฐานสำหรับผลทางเศรษฐกิจของการเลี้ยงสุกรพันธุ์นี้ โดยการศึกษาได้เลี้ยงสุกร 13 คลอก (จำนวน 78 ตัว) แบบระบบพื้นบ้าน และเลี้ยงสุกร 13 คลอก (จำนวน 98 ตัว) แบบระบบใหม่ ซึ่งในช่วงระยะการเลี้ยงพบมีลูกสุกร จำนวน 60 ตัว และสุกรขุนจำนวน 53 ตัว ในแบบระบบพื้นบ้าน และลูกสุกรจำนวน 90 ตัว และสุกรขุนจำนวน 71 ตัว ในแบบระบบใหม่ จากนั้นวิเคราะห์ลักษณะทางพันธุกรรมด้วยวิธี Restricted maximum likelihood (REML) กับแบบจำลองในสัตว์ด้วย multivariate analyses ผลการศึกษาพบว่า สุกรมีการเจริญเติบโตที่แตกต่างกันอย่างมีนัยสำคัญระหว่างการเลี้ยงสุกร 2 ระบบ โดยลูกสุกรในระบบใหม่ ในระยะดูดนมมีน้ำหนักเพิ่มขึ้น 2.18 กิโลกรัม และในระยะขุนมีน้ำหนักเพิ่มขึ้น 7.02 กิโลกรัม รวมถึงระยะเวลาในการขุนสั้นลง 56 วันเมื่อเปรียบเทียบกับสุกรในระบบพื้นบ้าน และพบว่าสุกรขุนในระบบใหม่ ได้น้ำหนักขายที่อายุ 255 วัน (น้ำหนักตัวเฉลี่ย 96.50 กิโลกรัม) ในขณะที่สุกรขุนในระบบพื้นบ้าน ได้น้ำหนักขายที่อายุ 311 วัน (น้ำหนักตัวเฉลี่ย 93.40 กิโลกรัม) และพบว่ามีลักษณะเฉพาะที่สืบได้โดยพันธุ์ที่เกี่ยวข้องกับการเติบโตของสุกรมีค่ากลางถึงสูง ได้แก่ WB 0.226, WW 0.328, ADGS 0.501, WR 0.673, ADGR 0.492, WF 0.703, ADGF 0.373, WEF 0.614 และ ADGL 0.495 ผลการศึกษาครั้งนี้สรุปได้ว่าควรมีการใช้เทคโนโลยีที่ทันสมัยในการปรับปรุงพันธุ์ และการเลี้ยงสุกรพันธุ์ Mangalitsa รวมทั้งการคัดสายพันธุ์ ปัจจัยด้านพันธุกรรมเพื่อเพิ่มอัตราการรอดชีวิต รวมทั้งการแข่งขันและตลาดการค้าสุกร

คำสำคัญ: Mangalitsa การเติบโต ระบบพื้นบ้าน ระบบใหม่ ลักษณะเฉพาะที่สืบได้โดยพันธุ์

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