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Izvorni znanstveni članak

EFFECT OF AGE AND WEIGHT OF YORKSHIRE GILTS AT MATING ON LITTER SIZE AND LONGEVITY

V. Vidović, D. Lukač, Ljuba Štrbac and M. Stupar

Summary

The efficiency of pigs production very much depend on, e.g., the number of weaned piglets per sow per year and longevity of sow production. So, health of animals, genetic, feed technology regime and management are most importance factors which influence to pig industry level of economy. To explained effect of age and weight of gilts at mating on litter size and life production then longevity we used Yorkshire females breed. The relationship between age and weight of Yorkshire gilts and litter size and longevity then culling level has been analyzed. The data structure included 3.886 gilts which has been sorted in three groups of age at fertile insemination (180-210 days; 211-230 days and 231-270days) and three groups of weight at the same time (90-114 kg; 115-130 kg and 131-170 kg). Management and nutrition of gilts and sows has been treated at common level of production. Analysis included data from 4 farms and period of two years production (2009. and 2010). MME – mixed model has been installed to use FYS (Farm, Year and Seasons) and litter as fixed effect and sire influence as random. Significant influence of age and weight on litter size has been recognized. Also those two factors had significant effect on longevity and production of sows. The best results had gilts introduced with age of 231-270 days and with class of 131-170 kg of weight. Those factors had significant influence to longevity and life production. Genetic and phenotypic correlations showed high and significant value. All results have been interpreted in 8 tables and 4 graphs.

The Yorkshire gilts have been selected as mother lines with 69% of selection to number of live born piglets, live piglets at day 5th and milk yield. Rest of criteria were use to improve gain, constitution, feed efficiency and meat content.

Key words: pigs, reproduction, longevity, age, weights, correlation.

Introduction

From economical and biological point of view there are common question of influence of age and weight at fertile insemination on litter size and longevity and life production of sows. Of course between those two factors there are high genetic relationship and significant influence on latter results.

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Since that sows use the same amount of food, so the question is hove many piglets can be weaned per sow per year or what is life production. Those two parameters are correlated to age and weight of gilts at fertile insemination.

The purpose of this paper was to analyze relationship and influence of age and weight of Yorkshire gilts at insemination in first five litters. We concentrate to analyze culling rates per successive litter and total number of live born and weaned piglets. Finally, heritability, genetic and phenotypic correlation between economically important reproduction and production traits has been discussed.

Material and Methods

To analyze influence of age and weight of Yorkshire gilts on litter size, culling rate and longevity of sows in production we used 3.886 gilts. All measurements have been done at 4 farms during 2 years and 8 seasons. All analysis included 5 litters.

We used following MME- mixed model analysis:

$$\mathbf{Yijkl = u + FYSi + Aij + Sijk + Eijkl}$$

Differences between FYS (Farms, Years and Seasons) then litters as fixed effects and random sires effects.

Age of gilts has been divided in three classes (180-210; 211-230 and 231-270 days. The weight of gilts we used to made also three classes (90-114; 115-130 and 131-170 kg) at insemination. The number of gilts in one of those classes is shown in table 1.

Table 1. – NUMBER OF GILTS WITH AGE AND WEIGHT AT FERTILE MATING

No of gilts	Age at fertile mating, days			Weight at fertile mating, kg		
	180-210	211-230	231-270	90-114	115-130	131-170
3.886	1.234	1.362	1.290	1.424	1.352	1.110

After MME analysis, heritability, genetic and phenotypic correlations has been estimated.

Results and discussion

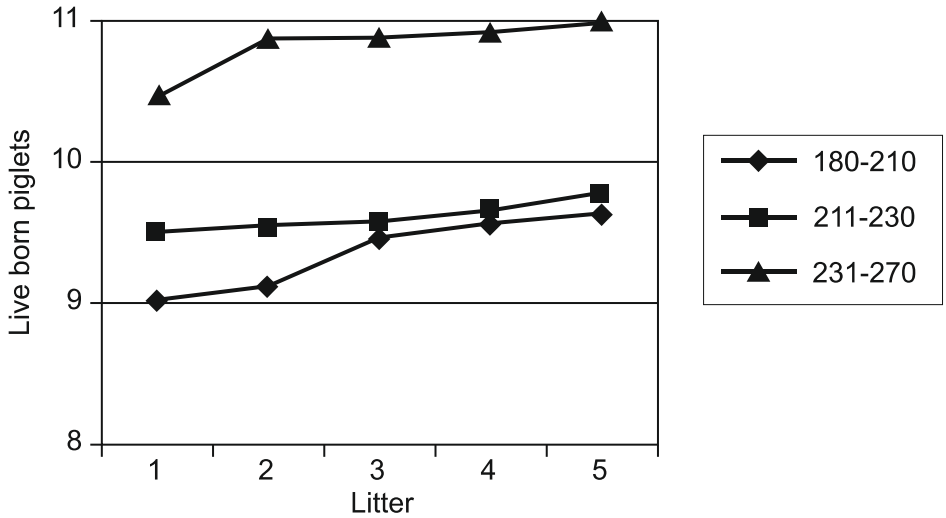
All analysis was interpreted in table 2-8 and 1-4 graphs.

Table 2. – EFFECT OF AGE AT MATING ON NUMBER OF PIGLETS PER LITTER

Litter	Age at mating											
	180-210		211-230		231-270		180-210		211-230		231-270	
	Live born piglets						Live piglets at day 5th					
	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ
1	9.02	2.3	9.51	2.0	10.46	2.1	8.57	2.2	9.35	2.1	10.55	2.1
2	9.12	2.2	9.54	2.1	10.86	2.1	8.69	2.3	9.39	2.0	10.60	2.0
3	9.46	2.2	9.58	2.1	10.87	1.8	8.99	2.2	9.40	2.1	10.74	1.7
4	9.56	2.2	9.66	2.3	10.91	1.7	9.25	2.3	9.44	2.0	10.82	1.8
5	9.64	2.1	9.78	2.4	10.98	1.8	9.29	2.3	9.67	2.0	10.82	1.7
Average	9.36	2.2	9.61	2.2	10.82	1.6	8.96	2.3	9.45	2.1	10.71	1.8

As we can see the effect of litters showed the same tendency in all classes. But, the differences between youngest and oldest gilts at insemination have been statistically significant. Weight of gilts showed the same tendency. Similar trend and conclusion for Yorkshire bred has been showed by Vidović and Lehocki 1998., Merks 2006, Vidović et al. 2011. Standard deviation also followed size of litter and there was no significant difference.

Graph 1. – EFFECT OF AGE AT MATING ON NUMBER OF PIGLETS PER LITTER



Graph 2. – EFFECT OF AGE AT MATING ON NUMBER OF PIGLETS PER LITTER AT DAY 5 TH

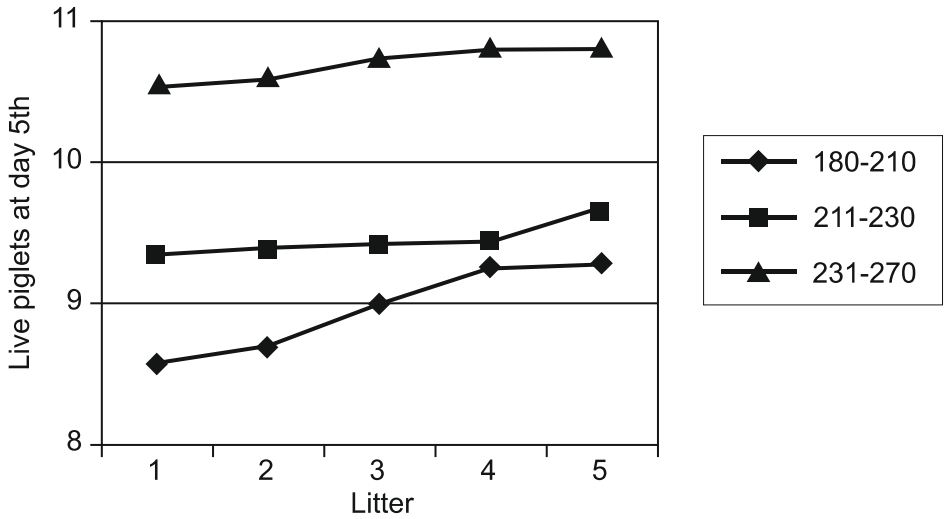
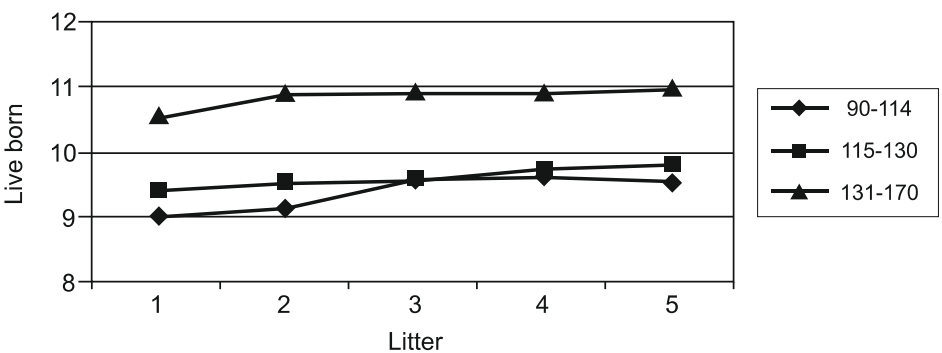


Table 3. – EFFECT OF WEIGHT AT MATING ON NUMBER OF PIGLETS PER LITTER

Litter	Weight at mating					
	90-114	115-130	131-170	90-114	115-130	131-170
	Live born piglets			Live piglets at day 5th		
	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ
1	9.00 2.3	9.39 2.0	10.52 2.0	8.72 2.1	9.20 2.0	10.20 1.8
2	9.12 2.3	9.52 1.9	10.86 1.9	8.76 2.0	9.27 2.0	10.28 1.8
3	9.60 2.2	9.57 1.9	10.91 1.8	9.14 2.0	9.30 1.6	10.81 1.8
4	9.62 2.0	9.70 1.8	10.91 1.8	9.o8 1.8	9.44 1.7	10.84 1.6
5	9.56 2.1	9.78 1.9	10.96 1.8	9.18 2.0	9.56 1.9	10.88 1.8
Average	9.38 2.2	9.59 1.9	10.83 1.8	9.00 2.0	9.35 1.9	10.60 1.8

Effect of weight on litter size and longevity were significant. The best results showed older and heavier gilts. The difference of age and weight effect on liter size and live production and longevity of sows have not being significant. Standard variation decreased by increased of age and weight of gilts at mating. It can be concluded that the best weight and age, according to final results are shown in class of oldest and heavier gilts.

Graph 3. – EFFECT OF WEIGHT AT MATING ON NUMBER OF LIVE PIGLETS PER LITTERS



Graph 4. – EFFECT OF WEIGHT AT MATING ON NUMBER OF LIVE PIGLETS PER LITTERS

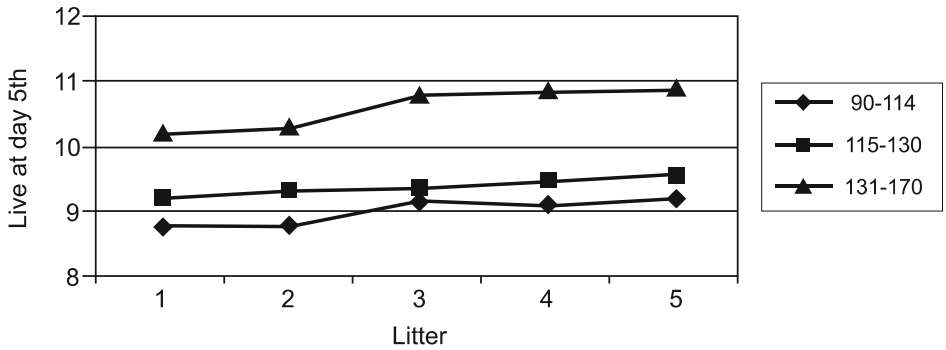


Table 4. – NUMBER OF STILLBORN AND WEANED PIGLETS IN DIFFERENT CLASSES OF GILTS

Litter	Age at mating gilts, days											
	180-210		211-230		231-270		180-210		211-230		231-270	
	Stillborn						Weaned					
	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ
1	0.9	1.9	0.7	1.4	1.0	2.0	8.16	2.0	9.14	2.0	9.54	1.4
2	1.0	2.0	0.9	1.4	1.1	1.7	8.22	2.1	9.21	1.9	9.58	1.4
3	1.1	1.4	0.9	1.6	1.1	1.8	8.45	2.3	9.23	1.8	9.62	1.3
4	0.9	1.6	1.1	1.6	1.1	1.8	9.62	2.2	9.27	1.8	9.82	1.3
5	0.7	1.4	1.0	1.6	1.0	1.5	9.68	2.1	9.34	1.5	9.88	1.6
Average	0.9	1.7	1.0	1.4	1.2	1.8	8.81	2.2	9.24	1.8	9.69	1.6

Stillborn piglets showed no significant difference between litters. More piglets in litter are followed with more stillborn. It could be consequence of technology and high selection pressure on number of live piglets.

Number of weaned piglets is significantly higher in class of gilts with older age and bigger size of weight. These figures lead us to conclusion to enter older and heavier gilts to production. The similar trend has been found by

Knap (1998)., Vidović and Lehocki (1998)., Vidović (1998., 2009., 2010., 2011).

Table 5. – RELATIVE REPLACEMENT RATE, %, ACCORDING TO AGE AND WEIGHT OF GILTS AT FERTILE MATING

Litter	Age at mating, days (Replacement rate, %)						Weight at mating, kg (Replacement rate, %)					
	180-210		211-230		231-260		90-114		115-130		131-170	
	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ
1 - 2	27	22	23	13	18	12	30	21	20	19	14	14
2 - 3	26	21	21	13	13	14	26	20	17	17	12	14
3 - 4	21	17	17	16	8	14	22	17	14	17	9	14
4 - 5	8	18	6	10	6	14	9	12	10	13	6	10

Younger and less heavy gilts are not capable to continue production continuously. They show negative effect of the next litter. It means they lost a weight of more the 40 kg in previous litter and have more than 12 empty days. In that case we are forced to cull them from production. Their life production is shorter, economically pure (Table 6 - 7). This result mean we have to enter gilts with older age and heavier (third class including age and weight).

Table 6: – GENETIC (ABOVE) AND PHENOTYPIC (UNDER DIAGONAL) CORRELATIONS BETWEEN CERTAIN TRAITS

	Age	Weight	Live born	Weaned	Stillborn
Age	-	0.86	0.69	0.64	0.12
Weight	0.59	-	0.65	0.62	0.15
Live born	0.58	0.76	-	0.89	0.13
Weaned	0.57	0.56	0.76	-	0.07
Stillborn	0.09	0.07	0.28	0.21	-

Table 7. – HERITABILITY ESTIMATES FOR LIVE BORN IN DIFFERENT LITTERS

Litter	Age at mating Weight at mating											
	180-214		215-230		231-260		90-114		115-130		131-170	
	Live born piglets											
	h^2	S_{h^2}	h^2	S_{h^2}	h^2	S_{h^2}	h^2	S_{h^2}	h^2	S_{h^2}	h^2	S_{h^2}
1	.09	.14	.09	.17	.10	.16	.11	.17	.11	.18	.12	.21
2	.09	.16	.09	.17	.12	.19	.10	.19	.10	.18	.10	.16
3	.09	.18	.09	.17	.09	.19	.09	.22	.09	.24	.11	.21
4	.07	.21	.06	.21	.09	.22	.09	.22	.12	.23	.08	.24
5	.09	.24	.09	.23	.12	.21	.10	.21	.10	.17	.07	.26

Table 8. – NUMBER OF WEANED PIGLETS PER SOW FOR FIRST FIVE LITTERS AT DIFFERENT CLASSES

Traits	Age at insemination, days			Weight at insemination, kg		
	180-210	211-230	231-270	90-114	115-130	131-170
Live born	36.7	45.9	51.3	37.2	44.9	51.6
Weaned	32.5	39.8	49.6	33.7	39.1	50.8

Genetic and phenotypic correlation confirm previous conclusion to select older and heavier gilts for higher number of piglets per sow per litter, life production and better economic benefit.

Conclusion

Effects of age and weight of gilts at fertile insemination on importance litter size traits and longevity of sows has been analyzed in Yorkshire

population. The significant best results have shown gilts with age of 231-270 days of age and weight of 131-170 kg.

Those age and weight of gilts had smallest culling rate during production and highest number of live born and weaned piglets in each litter and total production. These groups also have been longer in production.

These results has been confirm with significantly high and positive genetic and phenotypic correlations.

Standard deviation showed expected variation according trend and correlation between analyzed traits.

It can be recommend the optimal age and weight of gilts the third class (231-270 days and 131-170 kg) of gilts as economically the best one. To follow up this result it is necessarily to use new feeding technology and modern management system of production.

REFERENCES

1. Albart Costel, Ole Madsen, Henri Heuven, Johan van Arendonk andHenk Bovenhuis (2010): Detection of Imprinting in Two Commercial Pig Populations. WCGALP, 73 pp.
2. Bidanel J.P., Selier P. and Gilbert H. (2010): Genetic Association of Growth and Feed Intake with other Important Traits in Pigs. WCGALP, 87 pp.
3. Knap P.W.,Roehe R.,Kolstad K., Pomar C. and Luiting P. (2003): Characterization of pig genotypes for growth modeling. J. Animal Sci., 81: E 187 – E 195.
4. Kovač Milena and Šalehar A. (1985): Plodnost svinj na Slovenskih farmah v letu 1985.Poročilo za leto 1985.,406-412.
5. Merks J. (1994): Genetic relationship between age and fertility of Yorkshire gilts. WCGALP, 97 pp., Guelph, Canada.
6. Vidović V., Ljuba Štrbac., Lukač D. and Stupar M. (2011): Influence of age and weight of Landrace gilts… Biotechnology in Animal Husbandry (In press).
7. Vidović V. and Natalija Lehocki (1998): Some aspects of selection index efficiency at gilts production. Savremena polj.., 5-6, 212-220.
8. Vidović V. and Košarčić D. (1998): Artificial Insemination as a Segment of Pig Selection. Graph Style, 168 pp.
9. Vidović V. (2011): Teorija oplemenjivanja životinja. Graph Style, Novi Sad, 280 pp.
10. Vidović V. and Lukač D. (2010): Genetika životinja. Atelje, S. Kamenica, 361 pp.
11. Vidović V. (2009): Principi i metodi oplemenjivanja životinja. Atelje, S. Kamenica, 347 pp.

12. Vidović V. and Stupar M. (2010): Molekulska genetika. Atelje, S. Kamenica, 225 pp.

13. Srećković A., Vidović V., Stančić B.and Hajdu B. (1981): The correlation between age at the fertile mating and ferility in gilts of crosses of different genotypes. Arhiv za polj. nauke, 42 148, 519-532.

14. Šalehar A. (1985): Presoja plodnost na Slovenskih farmah ob desetletnici računalniške obdelave. Letno poročilo, 413-459.

UTJECAJ STAROSTI I TEŽINE JORKŠIR NAZIMICA PRI FERTILNOJ OPLODNJI NA VELIČINU LEGLA I DUGOVJEČNOST

Sažetak

Istraživanja su provedena na 3.886 plotkinja, smještenih na 4 farme, u dobi od 2 godine tj. 8 sezona (2009. i 2010). Cilj rada je bio ispitati utjecaj starosti i težine Jorkširskih nazimica pri fertilnom osjemenjivanju na rezultate plodnosti (žive, mrtve i zalučene prasadi) u prvih 5 uzastopnih prašenja kao i na dugovječnost krmača i proizvodnju. Oba faktora podijeljena su u tri klase. Primijenjen je mješoviti model analize utjecaja sistematskih faktora: - razlika između farmi godina i sezona, te prašenja po redu, kao i slučajni utjecaji: - razlika između očeva, na ispitivane osobine.

Dobiveni rezultati prikazani su na 7 tablica i 4 grafikona. Može se uočiti da je utjecaj oba faktora (dobi i težine) bio signifikantan na veličinu legla, broj živorođene i prasadi 5-og dana po rođenju, kao i na dugovječnost odnosno životnu proizvodnju krmača. Ovakvi utjecaji imaju i značajne ekonomske efekte na proizvodnju u praksi i ukazuju na opravdanost primjene ovih saznanja u proizvodnji. U zaključku, može se istaći da je, najoptimalnije vrijeme uvođenja nazimica u fertilnu oplodnju u uzrastu od 231-270 dana kao i u težini od 131-170 kg tjelesne mase. Vrijednosti genetskih i fenotipskih korelacija potvrđuju ovakav zaključak. Ekonomski gledano ovaj zaključak odnosi se na grla na svim razinama piramidalne proizvodnje. Ocjene heritabilnosti, i ako beznačajne za ovakvu vrstu analize, za ispitivana svojstva pokazale su stabilnost bez signifikantnih razlika između pojedinih klasa. Ako međutim znamo, da je heritabilnost za broj ovuliranih jajnih ćelija na razini (h2 -0,40), što ga svrstava u grupu srednje nasljednih, tada dolazimo do zaključka da su pored navedena dva efekta posebno važna i tehnologija i režim hranjenja plotkinja u pojedinim reproduktivnim fazama. Ovo stoga da se izazove fertilan estrus, preživi što više embrija i optimalne težine prasadi kao i kontinuitet u produktivnosti krmača sa optimalnim remontom.

Ključne riječi: svinje, reprodukcija, dugovječnost, dob, težina, korelacija.

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