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INFLUENCE OF AGE AND WEIGHT OF LANDRACE GILTS AT FERTILE INSEMINATION ON LITTER SIZE AND LONGEVITY

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Abstract: The relationship between age and weight of Landrace gilts both litter size and longevity then culling has been analyzed. The data structure included 1.615 gilts which have been divided in three groups of age at fertile insemination (180-210 days; 211-230 days and 231-260days) and three groups of weights at the same time (90-114 kg; 115-130 kg and 131-170 kg). Management and the nutrition of gilts and sows have been treated at common level of production. Analysis included data from 4 farms and the 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 were determined in gilts introduced at the age of 231-260 days and weight class of 131-170 kg. Those factors had significant influence on longevity and life production. Genetic and phenotypic correlations showed high and significant value. All results have been interpreted in 8 tables and 4 graphs.

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

Introduction

From economical and biological point of view there is the common question of influence of age and weight at fertile insemination on litter size and longevity of sows. Of course between those two factors there is high genetic relationship and significant influence on latter results. Since the sows use the same amount of food, the question is how many piglets can be weaned per sow per year or what is life production. Those two parameters are correlated to the age and the weight of gilts at fertile insemination.

The purpose of this paper was to analyze relationship and influence of the age and the weight of Landrace gilts at insemination in first five litters. We

concentrated on analysis of culling rates per successive litters and total number of alive and weaned piglets. Finally, genetic and phenotypic correlations between economically important reproduction and production traits have been discussed.

Materials and Methods

To analyze influence of the age and the weight of Landrace gilts on litter size, culling rate and longevity of sows in production we used 1.615 gilts. All measurements have been done at 4 farms during 2 years and 8 seasons. All analyses included 5 litters.

We used following MME- mixed model analysis:

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

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

Gilts were divided into three classes according to their age (180-210 days; 211-230 days and 231-260 days), and in three classes according to their weight (90-114 kg; 115-130 kg 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 the age and the weight at fertile insemination

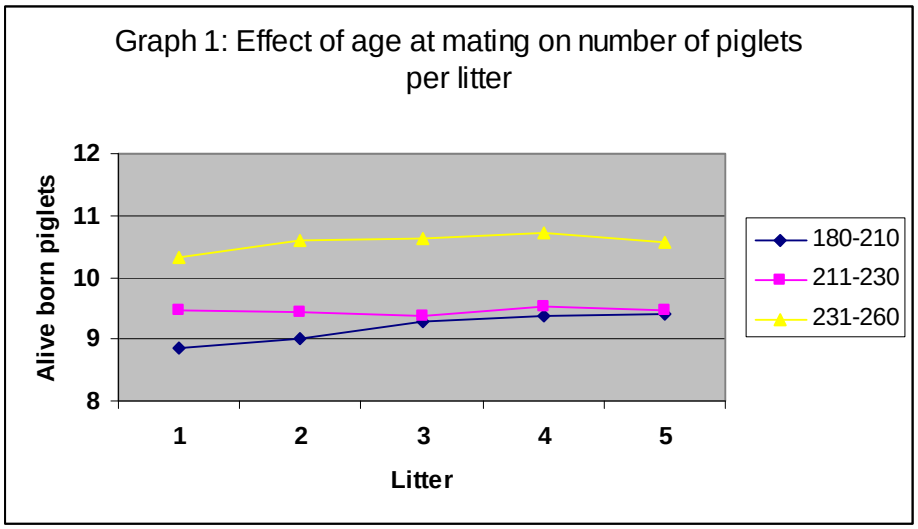
No of gilts	Age at fertile insemination, days			Weight at fertile insemination, kg		
	180-210	211-230	231-260	90-114	115-130	131-170
1615	434	682	499	409	525	458

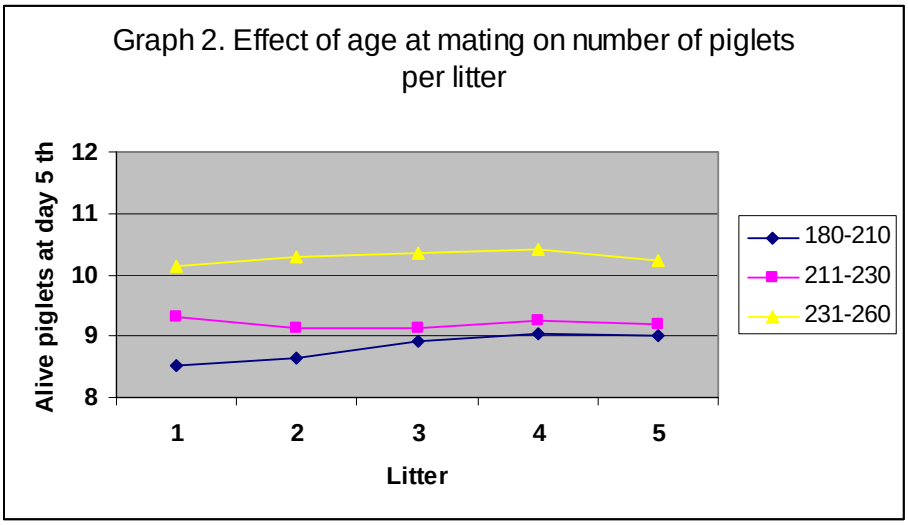
Results and Discussion

All data obtained in the study was interpreted in table 2-8 and 4 graphs.

Table 2. Effect of age at mating on the number of piglets per litter in Landrace

Litter	Age at mating					
	180-210	211-230	231-260	180-210	211-230	231-260
	Alive born piglets			Alive piglets at day 5th		
	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ	$\bar{x}$ σ
1	8.86 2.44	9.48 2.08	10.32 2.09	8.52 2.28	9.32 2.10	10.15 2.12
2	9.02 2.29	9.44 2.14	10.60 2.08	8.64 2.31	9.14 2.08	10.30 2.02
3	9.28 2.24	9.36 2.17	10.64 1.86	8.92 2.20	9.13 2.14	10.34 1.64
4	9.36 2.28	9.52 2.32	10.71 1.44	9.04 2.27	9.24 2.02	10.42 1.76
5	9.40 2.09	9.48 2.44	10.56 1.87	9.00 2.34	9.20 2.07	10.22 1.70
Average	9.18 2.44	9.46 2.17	10.57 2.04	8.82 2.38	9.21 2.12	10.30 1.84

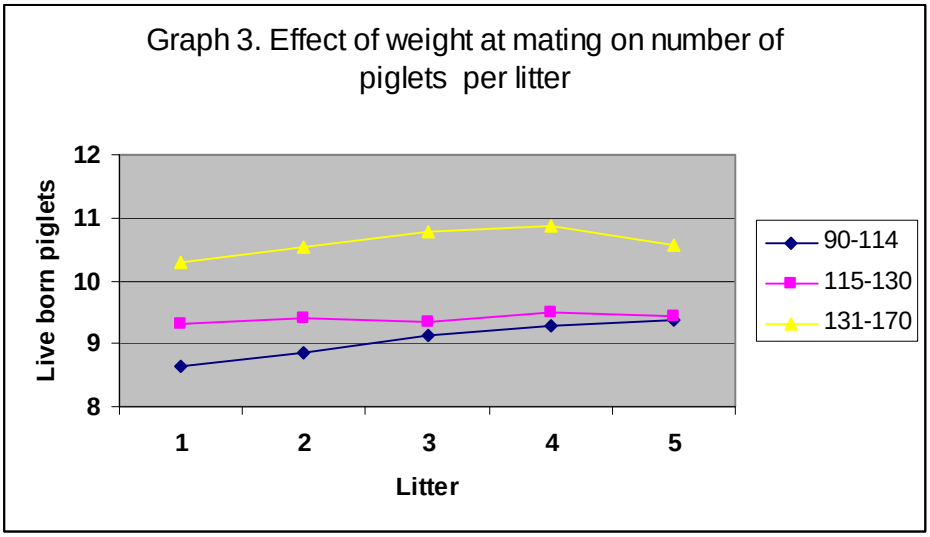


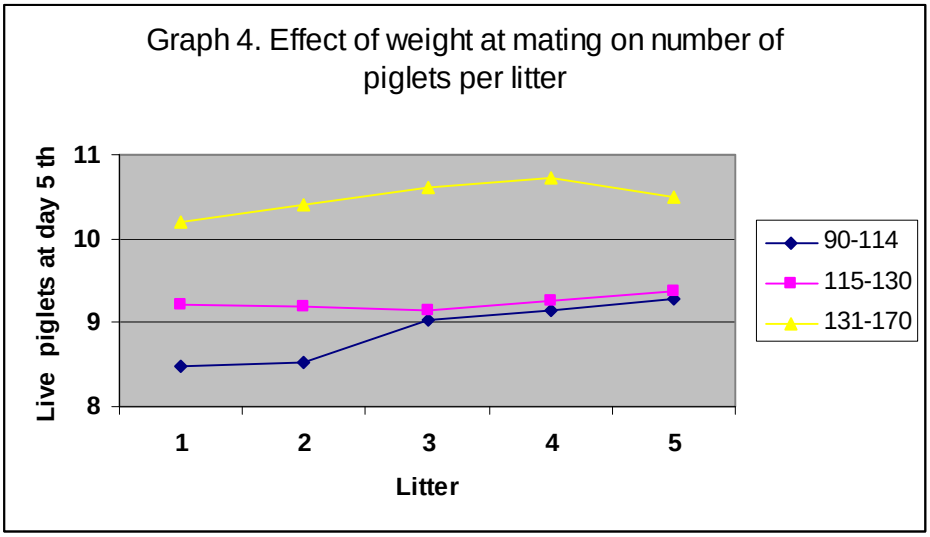


As we can see the effect of litters showed the same tendency in all classes. But, the differences between youngest and oldest gilts at insemination were statistically significant. Weight of gilts showed the same tendency. Similar trend and conclusion for Yorkshire breed was presented by *Vidović and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

Table 3. Effect of weight at mating on number of piglets per litter

Litter	Weights 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	8.64	2.74	9.32	2.08	10.28	1.98	8.48	2.34	9.22	2.10	10.20	1.45
2	8.87	2.38	9.40	2.04	10.54	1.90	8.53	2.28	9.20	2.11	10.40	1.60
3	9.13	2.44	9.33	2.00	10.77	1.86	8.02	2.10	9.14	2.08	10.60	1.86
4	9.27	2.54	9.50	2.30	10.86	2.00	9.15	2.08	9.25	2.36	10.72	1.66
5	9.38	2.50	9.42	2.24	10.56	2.08	9.28	2.14	9.37	2.30	10.50	1.80
Average	9.06	2.54	9.39	2.17	10.60	2.02	8.89	2.24	9.24	2.17	10.48	1.80





The differences between age and weight effects on litter of litter size and longevity of sows and their life production are not significant. The genetic and phenotypic correlations were high and positive. The best result were registered in females in the last class of age (231-260 days) and weight (131-170 kg). It is optimum size and age to include gilts in regular production level.

The gilts from the third class (age 231-260 day and weight of 131-170 kg) at first farrowing had between 190-220 kg of weight. With these sizes they display no syndrome of second litter. It means they have no more than 11 empty days and bigger litter then first one.

Effect of weight on litter size and longevity was significant. The best results were recorded in case of older and heavier gilts. The difference of age and weight effect on litter size and live production and longevity of sows wasn't significant. Standard variation decreased with the increase of age and weight of gilts at mating. It confirmed that the best weight and age, according to final results, were in class of the oldest and heavier gilts.

Table 4. Number of stillborn and weaned piglets in different classes of gilts

Litter	Age at insemination gilts, days											
	180-210		211-230		231-260		180-210		211-230		231-260	
	Stillborn						Weaned					
	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ
1	0.8	1.6	0.8	1.4	1.1	2.0	7.96	2.14	9.02	2.02	9.52	1.45
2	1.0	2.3	0.9	1.3	1.2	2.3	8.12	2.28	9.12	1.98	9.54	1.45
3	1.1	1.0	0.8	1.6	1.4	1.9	8.32	2.56	8.92	1.89	9.59	1.27
4	0.8	1.3	1.0	1.7	1.1	1.8	9.32	2.27	8.76	1.86	9.82	1.32
5	0.8	1.2	1.0	2.0	1.2	1.8	9.28	2.17	8.89	1.45	9.82	1.67
Average	0.9	1.6	0.9	1.3	1.2	1.8	8.60	2.08	8.94	1.86	9.67	1.60

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

Number of weaned piglets is significantly higher in class of older and heavier gilts. These figures lead us to the conclusion to enter older and heavier gilts into production. The similar trend has been established by *Knap (1998)*, then *Vidović and Lehocki (1998)*, *Šalehar (1985)*, *Kovač and Šalehar (1985)* showed similar trends.

Table 5. Relative replacement rate, %, according to age and weight of gilts at fertile insemination

Litter	Age at insemination, days (Replacement rate, %)						Weight at insemination, 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	30	23	26	12	22	14	31	24	27	18	21	13
2 - 3	27	20	21	14	14	15	27	22	26	16	17	14
3 - 4	22	18	17	16	8	15	24	19	20	17	10	13
4 - 5	8	23	6	12	6	14	9	16	9	14	8	12

Younger and less heavy gilts are not capable to maintain production continuously. They show effect of next litter. It means that they have lost weight of more then 40 kg in the 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). This result means we have to enter older and havier gilts (third class in regard to age and weight).

Table 6. Genetic (above) and phenotypic (under diagonal) correlations between certain traits

	Age	Weight	Live born	Weaned	Stillborn
Age	-	0.89	0.67	0.61	0.10
Weight	0.51	-	0.64	0.62	0.14
Live born	0.57	0.77	-	0.91	0.10
Weaned piglets	0.47	0.51	0.74	-	0.08
Stillborn	0.08	0.07	0.37	0.31	-

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	Sh^2	h^2	Sh^2	h^2	Sh^2	h^2	Sh^2	h^2	Sh^2	h^2	Sh^2
1	.07	.23	.07	.27	.08	.26	.09	.27	.11	.28	.12	.32
2	.08	.34	.08	.33	.07	.34	.010	.29	.10	.38	.10	.36
3	.09	.38	.09	.37	.09	.39	.08	.34	.09	.44	.09	.44
4	.07	.41	.06	.45	.08	.45	.09	.42	.08	.54	.08	.45
5	.09	.44	.09	.47	.08	.51	.10	. 45	.09	.57	.09	.56

Table 8. Number of piglets per sow for first five litters at different gilts classes

Traits	Age at insemination, days			Weight at insemination, kg		
	180-210	211-230	231-260	90-114	115-130	131-170
Live born	33.9	40.8	50.6	34.2	39.9	51.0
Weaned	30.2	37.7	47.8	30.7	38.1	48.2

Genetic and phenotypic correlations 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 litter size traits and longevity of sows has been analyzed on Landrace population. The significantly best results were established in gilts with age of 231-260 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. These groups also have remained longer in the production.

These results have been confirmed with significantly high and positive genetic and phenotypic correlations.

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

We can recommend as optimal age and weight of gilts the third class (231-260 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.

Uticaj uzrasta i mase landras nazimica pri inseminaciji na veličinu legla i dugovečnost

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Rezime

Istraživanja su izvedena na 1.615 plotkinja, lociranih na 4 farme, u periodu od 2 godine, tj. 8 sezona (2009. i 2010.). Cilj rada je bio ispitati uticaj starosti i težine Landras nazimica pri fertilnom osemenjavanju na rezultate plodnosti (živo, mrtvo i zalučene prasadi) u prvih 5 uzastopnih prašenja kao i dugovečnost krmača. Oba faktora podeljena su u tri klase. Za korekciju uticaja razlika između farmi godina i sezona, te prašenja po redu, kao sistematski uticaji i razlika između očeva, kao slučajan uticaj na ispitivane osobine, korišćen je mešoviti model analize.

Dobijeni rezultati interpretirani su u 8 tabela. Može se uočiti da je uticaj oba faktora (dobi i težine) bio signifikantan na veličinu legla kao i dugovečnost odnosno životnu proizvodnju krmača. Ovakvi uticaji imaju i značajne ekonomske efekte na proizvodnju u praksi. U zaključku, najoptimalnije vreme uvođenja nazimica u fertilnu oplodnju jeste u uzrastu od 231-260 dana i pri težini od 131-170 kg telesne mase. Vrednosti genetskih i fenotipskih korelacija potvrđuju ovakav zaključak. Istovremeno, ekonomski gledano je najpovoljniji uzrast kada grlo treba uvesti u proizvodnju bilo da se radi o nucleus ili komercijalnoj farmi. Ocene heritabilnosti, i ako beznačajne za ovakvu vrstu analize, za ispitivana svojstva pokazali su stabilnost bez signifikantnih razlika između pojedinih klasa. Ako međutim znamo, da je heritabilnost za broj ovuliranih jajnih ćelija na nivou (h2 - 0,40), što ga svrstava u grupu srednje naslednih, tada dolazimo do zaključka da je 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 embriona i optimalne težine prasadi kao i kontinuitet u produktivnosti krmača sa optimalnim remontom.

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