

**The use of laser to improve
semen quality and reproduction performance of sows.**

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In Belarus pig breeding is based on commercial technologies providing for artificial insemination. Its efficiency and profitability are mainly dependent on successful reproduction of herds. The control on reproduction cycles and recovering of reproduction functions of sows after farrowing provides an opportunity to predict the beginning of estrous in females and to inseminate them in due course. The quality of semen is of great importance too for intensive breeding.

In view of favourable results of laser beam utilization in medicine, a series of experiments have been carried out at the Institute to study a possible laser effect on biological active points (BAP) of sows and boars which control their reproduction function. Laser applied to sows with the intensity of 64 and 512Hz for 1 min stimulated their ovaries function. After piglets weaning, in 5 days the number of sows in heat increased by 36-40 % and the main part of them showed estrous (76-80 % vs. 40 % in control sows).

In 13 days the number of sows in heat increased by 84-92% vs 56% in control sows. Laser beam stimulation applied for improving reproduction activity had supplementary increased the number of animals in heat in 13 days by 28-36% (Table 1).

Table 1. The effect of laser beam utilization on sows` heat stimulation.

Groups	The number of herds	Animals in heat			
		From 1-5 days		From 1-13 days	
		The num. of herds	%	The num. of herds	%
Exp. 1, the intensity of 64 Hz	25	19	76	21	84
Exp. 2, the intensity of 512 Hz	25	20	80	23	92
Control	25	10	40	14	56

In experimental sows the pregnancy rate was found to increase by 8 and 14% respectively when compared to control ones. We explain this by more intensive regeneration during the accumulation of gonadal hormones and the development of follicles and ovules.

Sows` farrowing of all groups took place by 110-115 days after fertilization. Reproductive qualities are shown at Table 2.

Table 2. Evaluation of sows` productivity in comparison.

Groups	Fertilization from the 1 st insemination, %	Indices					
		Prolificacy, the num. of herds	Litter weight at birth, kg	Average piglets` weight at birth, kg	Litter weight weaned, kg	Average piglets` weight weaned, kg	The number of pig-lets weaned, %
Exp. 1	72	8.9	10.810.4	1.22	73.6412.2	9.05	92
Exp. 2	78	9.5	11.6810.4	1.23	83.2212.2	9.35	94
Control	64	8.9	11.1510.6	1.25	72.4912.8	8.86	92

The main physiologic processes in treated sows were not affected and we can consider laser as a heat stimulating and synchronizing factor in sows after piglets weaning. In experimental sows the pregnancy rate was found to increase by 14 % and the litter sire by 0.6 piglets when compared to control ones. However, the effect of laser on such reproduction traits as litter weight at birth and the number of piglets weaned was not revealed.

High fertilization rates of sows are known to depend as well on the semen quality that is influenced in its turn by breed and age of boars, their utilization rate feeding level, season and methods of semen collection. Experimental boars exposed to laser treatment for 1 min with the intensity of 64 and 512 Hz had higher libido. They got into excitement in a shorter time and needed less time to show their erection and copulation reflex. Their sexual behavior may be related to higher level of testosterone (by 37.7 % vs. untreated boars).

Table 3. Testosterone level in blood of boars.

Groups	The number of herds	Testosterone, mg/ml	
		Before exposing	After exposing
Exp. 1, the intensity of 64 Hz	8	7.6610.67	8.6910.73
Exp. 2, the intensity of 512 Hz	8	7.5910.70	10.4510.63**
Control	8	Without exposing 7.3110.73	

They had significantly better sperm production characteristics: semen concentration increased by 45-50 mln/ml, sperm cells motility and viability increased by 15-16 and 21-21.5 %, respectively. Their semen used to in-

seminate experimental sows was more fertility as the pregnancy rate of sows increased by 12 %, the litter size at birth was larger by 0.5 piglets and prenatal mortality was lower by 2.4 %. But at the same time the litter weight at birth and piglets viability were not affected. Estimation of sows` productivity is shown at Table 4.

Table 4. Estimation of sows` productivity in comparison.

Groups	Fertilization from the 1 st insemination, %	Indices					
		Prolificacy, the num. of herds	Litter weight at birth, kg	Average piglets` weight at birth, kg	Litter weight weaned, kg	Average piglets` weight weaned, kg	The num. of piglets weaned, %
Exp. 1	82	10.610.08	13.310.15	1.23	92.2611.3	9.26	94
Exp. 2	76	10.110.10	12.6210.20	1.25	83.1611.7	8.95	92

Laser exposing on the reproductive organs had a significant influence on body temperature, frequency of pulse and breathing. Results of their changing showed the esteem of exposing level, which outside irrigators made on animals. Laser beam utilization on BAP with different intensity hadn`t made any significant effect on body temperature, which increased on 0.10C vs control without any change. The frequency heart beating and breathing had increased after laser exposing depending on the intensity. Soon after the treatment all of indices came to the previous level.

Analysis of hematological and resistance indices showed increasing of leukocytes by 2.9%, total protein by 6.8, eosinopiles by 8.6%, lymphocytes by 3.6%, immunoglobuline A by 4.9% after laser exposing on boar`s BAP with the intensity of 512 Hz. Bacterial activity and betalysine activity of blood serum increased by 5.6 and 10.8 %, respectively.

Laser exposing on BAPs, which reflect the reproduction function was a heat stimulating and synchronizing factor in sows after piglets weaning and the factor of improving quality of sperm production, it provided the increasing of fertilization, prolificacy and the number of piglets weaned. But at the same time the physiological processes of animals weren`t affected.

To improve sperm quality biological methods of exposing were used on just ejaculated sperm. They influenced on increasing energy activity of cells membrane and cells membrane organelles, which provide regenerated processes, ATF organizing and increase oxygenic absorption.

Laser treatment of sperm cells improved their characteristics. After exposing to laser of 4.64 and 512 Hz for 15 s, sperm cells had better motility and viability; their acrosomes in 72 h of storage in a dilution medium was in a good state. The highest motility (6.2 points) and the lowest num-

ber of sperm cells with damages acrosomes were revealed in semen exposed to laser for 15 s at the intensity of 4 Hz. (Table 5)

Table 5. The effect of laser exposing on boars` sperm quality.

The object of exposing	Semen concentration, n	Type of exposing	Sperm cells motility after 72 hours of storage, bales	Sperm cells count with damage acrosomes in 72 hours of storage, %
Boars` sperm solution	60	4 Hz for 15 sec.	6.210.04	4.010.5**
	60	64 Hz for 15 sec.	5.910.04	4.610.5*
	60	512 Hz for 15 sec.	5.810.04	4.810.6

The fertilization rate of sows inseminated with such semen was higher by 6-8% when compared to control animals (Table 6).

Table 6. Evaluation of fertilizing ability of sperm cells.

Breed	The number of herds, n	Without exposing	The intensity of laser exposing	
			4 Hz, 15 sec.	64 Hz, 15 sec.
Large White	100	79	87	82
Byelorussian Meaty	100	80	88	83
Durok	100	77	83	80

The litter size and litter weight increased by 0.2-0.3 piglets and 0.3-0.4 kg, respectively when compared to control animals.

Table 7. Evaluation of sows` prolificacy by laser exposing on boars` sperm

Breed	The number of herds, n	Without exposing	The intensity of laser exposing	
			4 Hz, 15 sec.	64 Hz, 15 sec.

Large White	100	9.610.56	9.810.51	9.710.67
Byelorussian Meaty	100	9.410.55	9.710.73	9.510.57
Durok	100	8.810.60	9.010.56	8.910.75

Table 8. Evaluation of litter weight at birth by laser exposing on boars` sperm

Breed	The number of herds, n	Without exposing	The intensity of laser exposing	
			4 Hz, 15 sec.	64 Hz, 15 sec.
Large White	100	13.210.77	13.510.86	13.210.66
Byelorussian Meaty	100	12.810.79	13.110.81	12.910.80
Durok	100	12.610.82	13.010.78	12.610.75

In conclusion, the utilization of laser will help to synchronize estrous in sows and will ensure a high fertilization rate of gametes as well as a high quality of semen used for artificial insemination.