ABSTRACT OF PHD THESIS

For several hundred years, pork has had a significant role in the structure of consumption of meat and meat products.

The Romanian consumer´s preferences for pork shall take into account, to a large extent, the quantitative and qualitative requirements of energy and protein of animal origin.

The outstanding results in breeding pigs (over two farrowings per year, the high number of products per sow, obtained and weaned annually, the lactation capacity, etc.), the production performance (fast growth, good food conversion indexes, carcase quality, etc.), favourable climatic conditions and, last but not least, the tradition have strengthened the interest of breeders for this species.

The social-economic transformations after 1989, especially the changing of the land ownership structure, have changed the interest of the breeders, as they focused more closely both on the covering of their family needs and on the trading on the open market. The number of farmers interested in the pig breeding business development in small and medium farms with modern technological process to ensure economic efficiency increased.

The quality and efficiency in the exploitation of this species is largely influenced by the genetic value of the pigs used in production and reproduction. Only an optimized diet established according to the age and the physiological condition, along with the most advanced technologies able to highlight the existing genetic potential.

In the context of the globalized economy, of the EU integration and the rise to a maximum level of the competition due to the closure of the Russian market, obtaining pigs with a high-quality carcase is a prerequisite for all the Romanian pig breeders.

Both farmers and processors need carcases with a high content of lean meat, which means higher yields of the slaughter process, lowering the production costs and, proportionately, reducing the price of meat products.

Raising pigs for bacon can be a profitable business for the Romanian farmers, on the condition of using the modern technology and good quality biological material.

For this reason, in the doctoral thesis with the title " **CONTRIBUTIONS TO THE KNOWLEDGE OF THE TECHNOLOGY OF PRODUCTION AND QUALITY OF THE BACON PRODUCED IN DENMARK"** we intend to establish the production performance of pigs fattened for bacon, belonging to one of the leading suppliers of pork in the country.

The main reason for which Denmark was chosen to carry out these studies is represented by the country's recognized expertise in agriculture, particularly in the livestock sector, in raising pigs - the scope of my doctoral thesis research.

To this end, in this research we intended to monitor the breeding performance (fertility, prolificacy, lactation capacity, percentage of weaned piglets etc.) and production (average daily gain, specific consumption, body indices and meat quality) achieved by the Landrace x Yorkshire x Duroc half-breeds, intensively bred in Denmark, to produce the bacon.

Experiments aimed to determine the performance of breeding, production, slaughtering and meat quality of pigs bred for the production of bacon. Productive and reproductive performances were established in the SC C&C Bluhm Pedersen Farm during the period 2010-2013. In the Danish Crown slaughterhouse, slaughtering performances were established along with some meat quality parameters. To complete the information on meat quality, samples were collected and analyzed histologically, and they were statistically processed in specialized laboratories of USAMV in Iasi.

In Denmark, the bacon production is achieved after several cross-breedings:

1. Landrace and Yorkshire interbreed to give LY half-breed gilts;
2. LY half-breed gilts cross with Duroc boars to obtain LYD tri-racial hybrids;
3. The LYD hybrids are raised, fattened and slaughtered in order to obtain the bacon production.

Because our research had as main objective the reproductive and productive features of pigs raised for bacon, the biological material was represented by Landrace × Yorkshire half-breed sows and the Landrace x Yorkshire x Duroc tri-racial hybrids that are currently bred in Denmark for the production of bacon.

The general plan for the organization of the research was designed for four series of experiments, as follows:

The 1st series of experiments **"Contributions to the knowledge of the reproductive performance of the hybrids bred for bacon"** has as biological material 90 Landrace x Yorkshire half-breed gilts, divided into 3 groups:

- group L1 - 30 sows kept in 5-heads stalls;
- group L2 - 30 sows kept in 10-heads stalls;
- group L3 - 30 sows kept in 15-heads stalls;

The gilts representing the biological material for the first experiment series, were studied over six farrowings, being kept and bred under the same conditions from the beginning of their reproductive life until their reformation. The following reproductive parameters were monitored:

- fertility;
- the index of sows used for reproduction;
- females prolificacy depending on the season and the number of the farrowing;

- the number of weaned piglets per female;
- piglet mortality in maternity and its causes;
- the influence of the duration of lactation on the occurrence of heat.

After the first series of experiments we found that, for the studied sows, fertility was influenced to a lesser extent by the number of farrowing; there are small differences in the 6 analyzed farrowings, regarding the number of piglets. Comparing the recorded fertility values, in the 3 studied groups it is noted that, the average fertility was very good, over 90% in all groups (L1-92,22%; L2 - 91.66%; L3 - 91 66%) which indicates that Landrace x Yorkshire sows have outstanding maternal traits.

The index of the sows used for the reproduction had the best value in group L1 (5 animals per stall) 2.40, followed by group L2 (10 animals per box) 2.37 and group L3 (15 animals per stall) 2 35. The obtained values can be considered as very good, being in the limits shown in the technical literature, with values between 2.2 and 2.45.

Prolificacy was influenced by the season in a lesser extent, the best values were obtained in all groups in the spring season (13.9 to 14 heads), and the lowest during summer (13.5 to 13.8 heads). We can thus say that in industrial conditions, when the air conditioning of the halls is almost constant throughout the year, the seasons influences very little the prolificacy of the sows.

The number of farrowings influenced the prolificacy of the studied sows. Thus, in all groups, the best results were achieved in the third and fourth farrowing (13.9 to 14.1 heads) and the lowest in the first and sixth calving (13.7 -14.0 heads).

The loss of piglets until weaning, for the 3 groups, was about 10% compared with the technical literature which indicates a loss of about 10-15%, which can be associated with a particular quality of the sows, as well as the proper technology used during pregnancy and especially from farrowing to weaning.

Regarding the influence of the duration of lactation on the occurrence of heat, it was found that the best results were obtained in group L3 (39.8%) where the weaning of the piglets was done within 28 to 30 days.

The 2nd series of experiments **"Contributions to the knowledge of the productive characteristics of hybrids raised for bacon"** had as biological material 315 LYD half-breed pigs. To determine the influence of density on the productive performance, 235 pigs divided into four groups were analyzed:

- group L1, 105 animals kept in 5 stalls with 21 pigs per stall;
- group L2, 130 animals kept in 5 stalls with 26 pigs per stall;

To determine the influence of the season on the growth performance, we have studied 80 pigs of different ages, divided into 2 groups as follows:

- group L1 - 40 animals (barrows and females) - kept in 2 stalls with a capacity of 20 heads;
- group L2 - 40 animals (barrows and females) - kept in 2 stalls with a capacity of 20 heads;

The following parameters were monitored in the animals from the experimental groups:

- weight gain dynamics;
- average daily gain;
- food consumption during growth and fattening;
- food conversion index;
- losses and their causes.

Following the completion of the second series of experiments we found that, the mean values observed in the evolution of the body weight, made by the two experimental groups, indicate a superiority of the animals from L1 (99.4 kg) kept in the stalls of 21, compared with the animals in the group L2 (97.8 kg) kept in stalls of 26.

The data recorded for the average daily gain in the two groups, also indicate a superiority over the entire period of growth and fattening of the animals in L1 (765 g) compared to the animals in the group L2 (753G) about 8g;

The consumption index (kg fodder / kg growth) recorded throughout the experimental period was 2.52 kg in the L1 animals and 2.61 kg in the L2 animals, values that fall within the best results provided by the technical literature;

The piglet losses recorded in both groups were below 5% and they can be justified by the special quality of the genetic material used in the experiment, and the appropriate technology during growing and fattening;

Regarding the influence of the season on the productive indicators in LYD half-breed animals (Landrace x Yorkshire x Duroc) it was found that, in all the analyzed indicators (evolution of body weight, average daily gain, specific consumption, mortality) there were small differences between the groups growing during winter compared to those growing in summer. The small difference of about 1% of the lots can be explained by the very good artificiality of the environmental conditions at Svenneredgaard farm throughout the year.

The 3rd series of experiments **"Contributions to the knowledge of the slaughtering performance of hybrids used for bacon"** had 100 carcases as biological material, obtained from the pigs of the 2nd series of experiments, grouped into 2 groups as follows:

- L1 - 50 carcases obtained from barrows;
- L1 - 50 carcases obtained from females;

The following parameters were established in order to determine the slaughtering performance:

- slaughter efficiency;
- determining the muscular tissue percentage and the framing into quality classes;
- determining the thickness of the dorsal fat;
- commercial value of carcases.

The 3rd series of experiments revealed that the values of the slaughter efficiency were higher in L1 (78.07%) made of barrows, compared with the group L2 (77.88%) made of females; for this parameter, non-significant statistical differences between groups were calculated.

The framing of carcasses into quality classes showed that in L1 the carcases classified as Quality Class S (66%) prevail, and in L2 group the carcases classified as Class E (58%) prevail.

Regarding the percentage of muscle tissue it was found that the average was 60.7% in L1 and 59.2% in L2, marking a difference of 2.55% between groups, statistically significant differences being recorded.

In terms of dorsal fat, the achieved value was lower than the dorsal fat thickness in both measurement points, for the products of L1 compared to the products of L2. The last recorded values at the last rib were 17.6 mm vs. 18.4 mm, and at the medium Gluteus muscle of 20.2 mm vs 20.8 mm.

After determining the commercial value of the carcases it was found that in group L1 the average value was 118.09 euros and 116.4 euros in group L2, the difference between groups being 1.5%.

The 4th series of experiments - "**Contributions to the knowledge and qualitative assessment of the meat of hybrids used for bacon"** had as a biological material the samples taken from 70 carcases, grouped into four experimental groups.

In order to determine the physical and chemical characteristics of the production of meat, samples taken from 50 carcases were analyzed, grouped into 2 groups:

- L1-25 carcases obtained from barrows;
- L1 - 25 carcases obtained from females;

To determine the level of minerals as well as for the histological characterization, samples were analyzed which were taken from 20 carcases:

- L1 - 10 carcases obtained from males;
- L2 - 10 carcases obtained from females;

The following parameters were established in order to determine the meat quality:

- the colour of meat,
- the tenderness of the analyzed pork (Warner Bratzler shear forces);
-determining the acidity of meat;
-gross composition and energy value of the studied muscles;
- mineral content of the studied pork;
- histological characterization of pork.

Following the completion of the 4th test series we found that thecolor of the analyzed pork is described by a brightness value (L*) whose averages have fluctuated in the range between 52.76 and 53.61 units and 51.30 for the Longissimus dorsi muscle, and between 51.30 and 52.11 units for the Semitendinosus muscle.

The pork tenderness described by Warner Bratzler forces was characterized by a lower value of 39.09 N/cm ^{2} (Longissimus dorsi in females) and an upper value of 46.57 N/cm^2 (Semitendinosus in males).

During pork refrigeration/maturation, the pH dynamics showed a downward trend during the first 24 h after death; the average values recorded during that time are limited by the range of 6.25 to 5.55 in the Longissimus dorsi muscle of females and between 6.34 and 5.63 in the Semitendinosus muscle in males.

The animals' sex also influenced spontaneously the acidity of the meat; a possible cause may have been due to possible microbial loads of the two different muscles analyzed.

Data obtained on the composition of studied pork highlighted the following issues:

a) in the two analyzed muscle groups, the water content values were slightly higher in females compared to males; there were not statistically significant differences between groups;

b) it is noted that the water content was higher in Longissimus dorsi muscle (72.46% in males and 72.48%) than in Semitendinosus muscle (71.21% in males and 71.22% in females);

c) The average protein content reveals the uniformity of the composition in the two groups of examined muscles, varying between 23.30% and 23.21% in Longissimus dorsi muscles, and between 21.88% and 21.52% in Semitendinosus with minimum protein values mainly among females;

d) the pork fat was the component with the highest variation amplitude between the studied muscles, with higher values in Semitendinosus muscle (3.87% and 3.79%) compared to the Longissimus dorsi muscle (1.81% and 1.65 %), and higher values in males compared to females, with statistically significant differences between groups;

e) the mineral substances had close values. Males (1.46% and 1.53%) had a higher content of minerals compared to females (1.40% and 1.44%). Also, the mineral content was higher in Semitendinosus muscle compared to the Longissimus dorsi muscle.

The research results confirm the presence of heavy metals in organs and meat (Cd and Pb), which is quantitatively lower than maximum permissible limit (MPL) of 0.5 mg/kg and 0.1 mg Cd/kg for Pb (EC, 2006); average values range between 0.06 and 0.41 mg / kg SU for Pb and 0.025 and 0.12 mg / kg SU for Cd. The accumulation of these two heavy metals in muscle tissues and organs of pigs can be attributed to the contamination from the environment (water pipes, air) or the combined fodder.

It also confirms the presence of copper and zinc in large quantities (especially in the liver and the kidney), but they are considered essential metals in the balanced daily food ratio; the quantitative variation of each element is below the maximum limits for these metals;

The histological analysis of the muscles in the study indicated the presence of muscle fibres of different diameter, between 10 and 80 μm in both analyzed muscles. We note that the values obtained from females are slightly larger than the ones obtained from the males; there were not significant differences between the two groups.

The results from the investigations allowed us to make some recommendations:

- the continued use of Landrace x Yorkshire x Duroc half-breed in Svenneredgaard farm due to the outstanding performance of growth and the specific morpho-productive type for the production of bacon;

- for our country we suggest organizing, together with the specialized institutions, public meetings to inform the farmers of the area and not only (and other categories of consumers or farmers) about the advantage of using valuable biological material in the technology of swine breeding and use, with the ultimate aim of improving the breed structure of the N-E Moldova and of creating conditions for the profitable livestock enterprises in the small business sector.