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THE USE OF BREEDING BIOTECHNOLOGIES IN ROMANIAN LIVESTOCK

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Abstract.

For livestock holdings, the breeding sector is the most important and the level of breeding technical indicators is the path to profit or loss. It can be said that in animal husbandry, this is the sector with the highest degree of technicality and that is why there were made efforts in research to create modern techniques that allow the man to control all these phenomena and the level of indicators to not depend only on the capabilities of the bull, boar, ram and rooster, etc.
The aim of this paper is to provide a view upon the use of breeding biotechnologies in Romanian livestock. Based on the data of National Agency for Improvement and Reproduction in Animal Husbandry were analyzed the dynamics of artificial insemination, in species of livestock contained in Official Control of Production (COP). The dynamics of embryo transfer in cattle, in Romania, in the period 2000-2012 is based on data reported by the Romanian Association of Embryo Transfer (A.R.E.T.) to the European Association of Embryo Transfer (A.E.T.E.).
Although until 1990 agricultural research and the system of state enterprises favored the application of these biotechnologies, after 1990, the highly divided property in agriculture and the lack of organization of farmers in associative forms resulted in the restricted use of these modern techniques.
Regarding the use A.I., in the analyzed period, the total number of A.I. decreased by 55%, due to the changes that have occurred since 1990, with the restructuring that occurred in livestock (reducing the number of large farms and the continue decline of the number of females) and in the national network of breeding and selection of animals.
In Romania, due to high costs, embryo transfer is not a method currently used and accessible to ordinary farmers, being used mostly to obtain the bulls used in artificial insemination network or the cows as steers mothers.

Keywords: breeding, biotechnology, artificial insemination, embryo transfer

1. INTRODUCTION

The biotechnologies of I-st degree, such as artificial insemination and embryo transfer have caused profound changes, favorable in improving breeds and animal production, thanks to them there were developed biotechnologies for raising cattle, sheep and goat specialized for meat and milk. [1]
Artificial insemination is a modern biotechnological method and the only means of dissemination of genetic progress and for application of the most efficient methods of selection breeding livestock, this practice demonstrating that, regardless of species, when it is properly organized and implemented, the result is better technical indicators and high yields. [3]
Dinu I. et al. in the paper "Special problems of improvement and exploitation of pigs" states that this method helps to speed up the pace of improvement in the populations and consequently makes that the efficiency of selection and the genetic progress to increase significantly.
Application of artificial insemination makes it possible to check the semen product before the use of young animals for breeding, which is a guaranteed safety of biological material. [5]
The begining for introduction into practice of this method is due to veterinary reasons during 1956-1960 in western Europe. After this there were a period of decline due to high costs, technical imperfections and poor quality of results, but as a result of research in the field and continuously improving of the parameters, after 1980 we are witnessing a strong comeback. Currently the method is bound to increase and in many countries there are well-developed network of centers for processing and distribution of semen. [7]
Artificial inseminations are important in terms of zoo-economic, due to intensive use of value breeding animals, with great individual potential, which results in speeding up the pace and degree of improvement in livestock. [8]
By using artificial insemination biotechnology, for breeding there are used only males tested by descendants so that, besides the high quality of sperm, there is also a real test for the improvement value. [11] On the other hand, by freezing semen was created both the international exchange of semen genetically valuable, even at intercontinental distances, without transport and acclimatization costs for breeding animals and the formation of deposits for semen of high genetic value breeding stock. [18]
Testing by descendants for breeding animals by using artificial insemination can be achieved more quickly, and by a complex examination, zootechnicaly and veterinary, it can find males with various congenital abnormalities of the genitalia or hereditary disorders of spermatogenesis, realizing a genetic prophylaxy of sterility. [16] Due to strict records kept for all operations that are performed, threre is better known the paternity of offspring.

Embryo transfer is a basic technology across modern biotechnologies, which includes a complex of works that refer to obtain a large number of fertilized eggs (zygotes) or embryos in the first stages, from donor females, handling them "in vitro" (examination, sorting, cultivation, conservation and storage) and finally the implantation in the uterus of one or more receiver females. [2] From zootechnical point of view, while the donor females must be of high value, the receivers only serve as natural incubators, leading the pregnancy to final and having no genetic influence on products. [4]
Embryo transfer is a polifactorial technological process, the success of this method depending on the likely variation within each sequence. Although these technological sequences remain in the same order for all species, there are still differences within them related to the anatomical and physiological characteristics of species. Thus, for cattle both collection and embryo implantation are already performed non-surgicaly, which makes this biotechnology be as feasible as artificial insemination. [10]
Using this biotechnique results in obtaining of high genetic performance cores in a short period of time, which could be used to create new breeds or lines and consolidating the desired characters in the population. [17] To avoid health risk the embryo transfer can be used even as a substitute of S.P.F. provided they comply with international regulations on accreditation of the center, staff training, rules for handling and processing of embryos. [9]
Not ultimately, embryo transfer is a method capable of saving endangered populations or breeding livestock not used for breeding due to low skills or from different economic motivations. [15]

2. MATERIAL AND METHOD

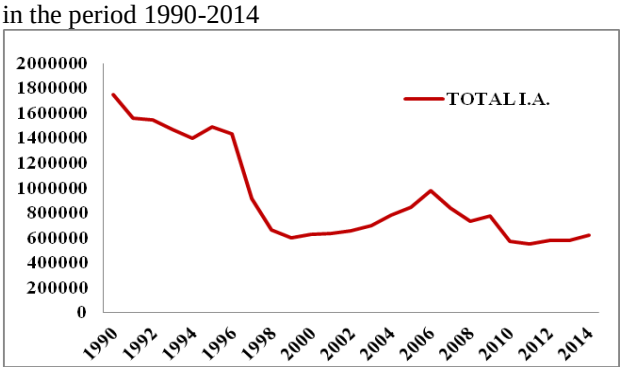
This study aims to analyze the evolution in the use of artificial insemination and embryo transfer in Romanian animal breeding. The methodology used was analysis and synthesis of data to identify the causes that led to the current situation. For the introduction of the paper there were consulted numerous bibliographic sources which provide valuable information on the zoo-economical benefits of using the breeding biotechnologies.
Further, in the work, on the basis of data from the National Agency for Improvement and Reproduction in Animal Husbandry is analyzed the artificial insemination weight and the obtained offspring by species, for livestock contained in Official Control of Production.
The dynamics of embryo transfers in cattle in Romania during 2000-2012, are based on data reported by the Romanian Association of Embryo Transfer to European Association of Embryo Transfer.

3. RESULTS AND DISCUSSIONS

3.1. Artificial insemination in cattle

Due to special advantages, artificial insemination is the main system used in cattle. Among the many advantages of using A.I., presented in the introduction of this paper, is enough to mention the ameliorative effect exercised by applying "selection pressure by males" and spending less on gestation, plus the possibility of exchanging valuable genes between areas or countries.
Selection in cattle has a significant share in the work of the National Agency for Amelioration and Reproduction in Animal Breeding (ANARZ) and its offices in the teritory and the selection work are in correlation with the directions of exploitation of breeds that determines the improvement objectives and share different criteria in genetic evaluations of breed populations. In Romania, after privatization of SEMTEST units, frozen semen was assured by collection and storage centers accredited and dissemination is the responsability of National Agency for Amelioration and Reproduction in Animal Husbandry and its subordinate regional units.
In 1997, in Romania there were a total of 4.884 points for artificial insemination in cows (PIAV), and about 5,600 operators, their number reduced gradually so that at the end of 2014 there were 2,647 PIAV sites with precarious technical equipment and only 2608 operators. On the other hand, since 2006 the reproduction and artificial insemination activities have been outsourced, being conducted by livestock associations, authorized by ANARZ, which led to malfunctions between associations authorized for purchase, storage and supply PIAV with frozen semen and on the other hand, the units for production and / or selling the msc, including operators.
In the dynamics of artificial insemination in cattle under the COP in the period 1990-2014, the share of artificial insemination decreased from 1.7504 million A.I. in 1990 to 621500 A.I. in 2014, accounting for 35.51% compared with 1990 (chart 1). This decline was relatively mild until 1996 (accounting for 81.82% in 1996 compared to 1990) and then since 1997 the dynamics of A.I. was sinuous, decreasing during 1997-2000, growing in the period 2001-2006, followed by decreases again in 2006-2011.

Chart no. 1: Dynamics of artificial insemination in cattle in the period 1990-2014



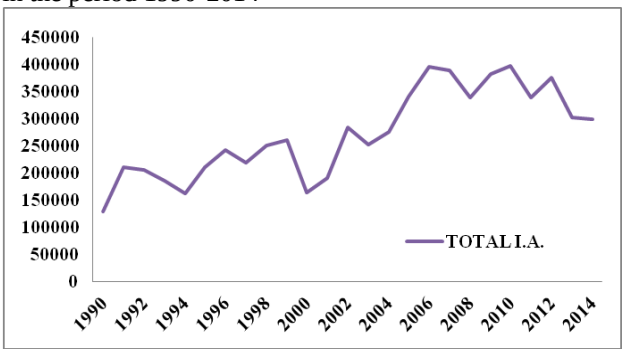
According to ANARZ data, in 2014, the total cattle female censored, was 1,622,963 heads, with the following structure of breeds: Brown 13.58%, 30.96% Romanian Spotted - Simmental, 20.28% Black Spotted Romanian - Holstein Friesian, 0.6% Pinzgauer, 32.86% half breeds, meat breeds 0.16%, 1.02% other breeds and

0.54% undefined. From the number of females census by age is obtained the stock of breeding females able for reproduction for the current year, to be included as appropriate, for natural service or artificial insemination.
At the level of development regions, the percentage of artificial insemination reported to the breeding stock was 47.8% in the Northeast, 42.7% in the Southeast, 35.9% in the South, 70.2% in South west, 73% in the west, 80.9% in North west, 77.3% in the Centre and 70.4% in Bucharest - Ilfov region.
With all the advantages offered by the biotechnology of artificial insemination in cattle, it can be seen that natural service occupies a considerable share from the total inseminations for this species due and the large number of holdings of small size, over 95% of total holdings of cattle having between 1-7 cows. If we analyze the situation of progeny derived from cattle entered in COP, we notice that the birth index for artificially inseminated cows had a sinuous evolution, with increases and decreases from year to year. Higher values of the birth index, for artificially inseminated cows were recorded in 2007 (98.85%), 2008 (94.31%) and 2010 (98.38%).

3.2. Artificial insemination in swine

Artificial insemination in pigs was introduced in industrial -type complexes in our country since 1967, but the system has been developed and more broad in many I.S.C.I.P. and A.E.I.C.I.P. units between 1975-1980. Practical experience, show the superiority of artificial insemination versus natural mating. Expanding the A.I. system with boars authorized on the basis of the value of improvement and the imports of breeding animals with high value of improvement, positively influenced the production and breeding parameters in swine.
In Romania, swine genetic improvement is achieved by selection and hybridization on the basis of the performance of breeding and production in two categories of farms: breeding farms for pure breed pigs and breeding farms for hybrid pigs. At national level, in 2014, 2766 farms were accredited as selection units (which are pure breed pigs) and 16524 hybridization farms.
The breeding stock of swine, contained in COP, increased between 2005-2006, followed by declines in the next years due to the decrease of both the livestock and the number of farms of pure breed. According to ANARZ data, the share of swine breeds included in the COP, in 2014, was as follows: Great White (36%), Landrace (27%), Pietrain (1%), Duroc (0.4%), hybrids (36, 6%).
During 1990-2014, the dynamics of artificial insemination in pigs under the COP, marked an increase from a total of 128 977 A.I.in 1990 to 298418 A.I. in 2014. During this period the increase of artificial inseminations was not uniform, because there were years when their total number decreased (chart no. 2).
From existing data of ANARZ, at local level, the regions with the highiest number of artificial inseminations in pigs under COP are Western region and South East region. Decrease in A.I. number in recent years it is related to drastic reduction of the number of pigs, for example Bucharest - Ilfov region marked a downward trend in terms of dynamics of A.I. in pigs, since 2006, due to downsizing from S.C. Romsuintest Peris, the main unit for breeding pigs in the region.

Chart no. 2: Dynamics of artificial insemination in pigs in the period 1990-2014



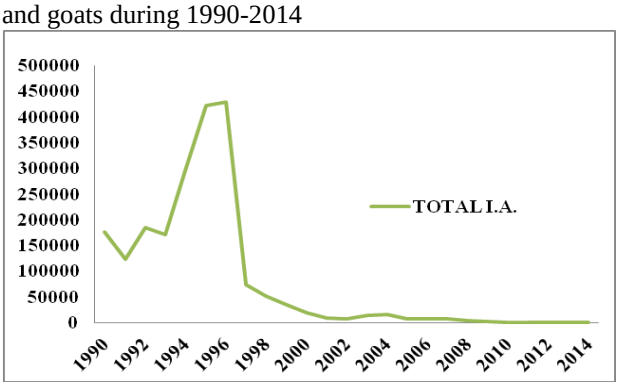
From data analysis of descendants obtained from pig entered the COP, we see that the best results obtained after artificial insemination in pigs were carried out in 2011-2014. For example the number of piglets obtained in 2014 from artificially inseminated sows was 17.5 piglets/sow/year, respectively 8.8 piglets /I.A., compared with 14.41 piglets/sow/year for sows with natural service and 7.2 piglets on each natural service.

3.3. Artificial insemination in sheep and goats

In sheep, artificial insemination has encountered difficulties because the heat detection is very difficult, with intensive labor, which is why it seeks the development of a biotechnique of "blind insemination" consisting of induction and synchronization of oestrus by hormone treatment (intravaginal progesterone pessaries) and insemination without heat detection. [6]
In sheep, because of biological particularities of the species, selection work vary during the year depending on the reproductive cycle and specialization of breeds for certain productions.
The breeds structure of livestock contained in C.O.P. show the interest of farmers for both rustic breeds well adapted to the geo-climatic conditions of Romania and breeds specialized for certain productions.
The existing breeds in our country are mixed breeds exploited for different productions depending on their biological potential and level of selection. The share of indigenous breeds of sheep, contained in COP, account for 92.17%, respectively: Țurcană (80.07%), Tigaie (6.43%), Palas Merino (3.58%), Karakul of Botosani (2.09%).
Turcana holds the most important weight in most counties in the country, because its special resistance and production capability. It is well suited to the mountain conditions of exploitation but also occupy important areas in hills and plains. Livestock of this breed have become heterogeneous in terms of production parameters, with good milk production cores or with a high prolificacy or with a good average daily gain.

The share of artificial insemination in sheep and goats has recorded a downward trend, from 1.89% in 1990 to 1.05% in 2014, ie from a total of 177223 in 1990 to 1169 A.I. in 2014. Note that in the period 1992-1996 was recorded the highest number of A.I. in these species namely 186.151 A.I. in 1992, 297,000 A.I. in 1994, 422 900 AI in 1995 and 430 369 AI in 1996 (chart no. 3).
At the territorial level, in 2014, the artificial insemination of sheep and goats contained in COP was practiced only in two counties, a total of 1,014 A.I. in goats, in Constanta County, and 155 A.I. in sheep in Ialomita county.

Chart no. 3: Dynamics of artificial insemination in sheep and goats during 1990-2014



The total number of offspring produced by A.I. sheep and goats in 2014 was 1268 of which 148 lambs and 1120 goatlings. During 1990-2014, the value of birth index for sheep and goats, included in the COP, recorded slight increase from 96.94% in 1990 to 106.1% in 2014.

3.4. Embryo transfer

According to FAO regarding the use of embryo transfer, 16 of the 25 countries that use biotechnology. Of the 16 countries, 11 use embryo transfer in cattle, three in sheep, two in goats, one in pigs, one in horses and one in rabbits, using embryos from both imports and local breeds. This biotechnology accelerated the growth of production performance through genetic improvement, but has the disadvantage of high costs and therefore some countries have abandoned the programs M.O.E.T. (Multiple Ovulation Embryo Transfer), which is why this biotechnology is much less used than the artificial insemination.
In Romania, due to high costs, embryo transfer is not a currently used method and accessible to ordinary farmers, beeing used more frequently to obtain bulls used in artificial insemination network and for cows which are mothers of bulls.
In our country there are 3 teams which are veterinary authorized, applying embryo transfer in cattle for commercial reasons and several teams of specialists in animal reproduction, working in universities and research units.
The dynamics of embryo transfers in cattle and in Romania during 2000-2012, according to data reported by the Romanian Association of Embryo Transfer (A.R.E.T.) to the European Association of Embryo Transfer (A.E.T.E.) is presented in table. 1.

Table 1: Dynamics of embryo transfer in cattle in the period 2001-2012

Year	Nr.of donors	Embryos collected	Transferable embryos	Frozen embryos	Embryo transfered	Fresh embryo transfer	Frozen embryo transfer	Nr. products obtained
2001	11	49	37	-	37	20	17	4
2002	27	209	194	14	180	105	75	63
2003	22	178	114	69	83	48	35	6
2004	27	218	205	-	162	95	67	21
2005	18	135	86	17	69	40	29	21
2006	22	215	104	74	41	24	17	17
2007	25	235	119	78	46	27	19	19
2008	15	108	77	34	62	36	26	28
2009	23	185	109	105	71	42	29	22
2010	27	168	129	101	73	43	30	29
2011	23	174	124	72	60	35	25	21
2012	5	36	33	22	30	9	21	18
Total	**245**	**1910**	**1331**	**586**	**914**	**524**	**390**	**269**

Source: A.R.E.T data processed by author

Analyzing the data presented in table 1 we can see that during the period 2001 to 2012 were treated for induction of oestrus and poliovulation a total of 245 donor cattle, from which were collected 1910 embryos, an average of 7.8 embryos / donor.
Following microscopic evaluation, 69.7% of the total collected embryos (embryos 1331) corresponded in terms of morphology, beeing considered potentially transferable embryos. Thus, at national level, a number of 914 embryos (524fresh embryos and 390 frozen embryos) have been transferred to receivers, following the implantation of embryos 269 products were obtained, representing 29.4% of embryos transferred.
From the data presented, it appears that the biotechnology of embryo transfer is still underutilized, for genetic progress in animal husbandry in our country.
The success of embryo transfer is conditionated by a number of factors, among which could be considered: the quality of embryos, the storage and handling conditions, the time from collection to implantation, the type of transfer (surgical or nonsurgical), veterinary status and the condition of receivers, synchronization of oestrus for receivers and donors and the ability of the operator who perform the transfer. [17] These factors act on each stage of this biotechnique and interact with one another, making it difficult to detect the responsible factor for the ineffectiveness of the method or poor results. For a wider use of this biotechnique it is necessary, on the one hand, the improvement and the constancy of results, and on the other hand, the reduction of costs.

4. CONCLUSIONS

Before 1990, the research in agriculture and the system of state enterprises were favorable to application of biotechnologies in Romanian livestock production, but after 1990, the changes in this sector had as result the use on a smaller scale of these modern tecniques, due to the fact that the cost of equipments and workmanship was not possible to be supported by small farmers.

Between 1990-2014 the total number of artificial inseminations in main animal species recorded decreases due, on the one hand, to the significant reduction of livestock, and on the other hand, to restriction, or even dissolution of livestock units that used this biotechnology in animal reproduction.

In cattle, the species that has the largest share of artificial insemination (62.05% of the total AI in 2014) the number of artificial inseminations in this species has decreased by 64.49% compared to 1990. In addition to the sharp drop of herds in this species, an important cause of reducing the number of artificial inseminations has been the reduction by approximately 50% from the number of AI points in cows and of the number of operators, at the end of 2014 there were only 2647 PIAV and 2608 operators.

In swine species, the total number of artificial inseminations marked a significant increase, from a total of 128 977 A.I.in 1990 to 298418 A.I. in 2014, growth beeing not uniform from one year to another.

In sheep and goats, the total number of artificial inseminations decreased considerably, from a total of 177 223 A.I. in 1990 to 1169 A.I. in 2014, basically only in two counties (County of Constanta and Ialomita County) they made artificial insemination in these species. The causes of decline of interest in this biotechique are organizational and financial plus difficulties in detecting oestrus in females of this species. Switching from the type of intensive exploitation to extensive exploitation, of pastoral type, based on transhumance, makes technological organization more difficult and the transport and labor costs are very high.

Embryo transfer biotechnology is still insufficiently used for genetic progress in Romanian animal husbandry, cattle beeing the only species that use this biotechique. In the period 2001-2012, there were treated a total of 245 donor cattle for induction of poliovulation, from which was obtained an average of 7.8 embryos / donor and after embryo implantation in cows receivers, 269 products were obtained, which represents 29.4% of embryos transferred.

The low interest to this biotechnology lies in the fact that it is a biotechnique more laborious, requiring expensive equipement and qualified personnel, successful embryo transfer beeing related to a number of factors: the quality of embryos, storage and handling conditions , the time from collection to implantation, the type of transfer (surgical or nonsurgical), veterinary status and the condition of receivers, synchronization of oestrus for receivers and donors and the ability of the operator who perform the transfer.

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