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ESSAY ON ESTIMATION OF UNDEMONSTRATIVE SPARE OUTPUTS DISCLOSED BY REPRODUCTION BIOTECHNOLOGIES IN SHEEP BREEDING

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Abstract

Among genetic species of farm animals sheep has the highest artificial biodiversity. There are plenty of breeds due to the many kinds of biological production of human interest and to the large areas from plains to mountains and fro Equator to Poles engaged in sheep breeding. Sheep are producing wool (thin, meddle or thick), lambs, mouton (lean or fat), milk, pelts, furs or leather, each of them acting as single selection criterion or as component of selection indexes. Each kind of resulted product has its own commercial value and its way of appreciation it. In many cases the commercial value of sheep breeding is related to the ewes' fertility. On the other hand ewes have seasonal sexual activity including a longer or shorter period of anoestrus when produce nothing related to their fertility. Biotechnological means as artificial insemination, estrus induction, arouse of ovulation rate, embryo transfer, MOET, embryo cloning, in vitro fertilization, transgenice engineering are able to influence the economic efficiency of sheep breeding. The present essay is configuring modalities of estimating the increase of economic value of sheep products when research programs of developing reproductive biotechnologies in ewes implemented in sheep farming.

Key words: *artificial insemination, in vitro fertilization, moet, reproduction, sheep,*

INTRODUCTION

Generally speaking animal farming aims to offer for the market goods in order to get profit. The profit level depends on the relation existing for each product between the price per unit of product and the cost of the same unit. A good price of product is obtained when the product is much required and small quantities of it are offered by producers.

The output of farms is given by the obtained price per product unit and by the quantity of produced goods doesn't matter if they were sold or not yet. Costs are classified in variable costs which modifies together with the produced quantity of goods, fixed costs, which are inherent for production and maintain their level even the production is stopped, and added fixed costs as taxes, publicity or other expenses of the kind [4].

The difference between the total output and the variable costs is giving the farm gross margin. The farm gross margin minus the fixed costs gives the farm profit or loss, or gross profit. The gross profit minus the added fixed costs gives the net profit of the farm.

In order to measure value each country uses its currency. There is an each day currency quotation changing the quotas of peculiar currencies. Prices are frequently changing with the offer and require of the market. That modifies the level of costs as well.

For these reasons the authors of this essay will not use the Romanian currency in the economic analysis of reproduction biotechnology effect in sheep breeding. They will imagine analyses for each peculiar case.

MATERIAL AND METHOD

Considering the complexity of the present theme the essay will discuss the diversity of goods produced with the sheep and their biodiversity [8], will underline the maine reproduction particularities of this genetic species, will show the virtues of the applied biotechnics in reproduction with ewes [10] and will suggest opportunities to use them in order to disclose undemonstrative outputs of sheep flocks, based on their former experiments [1].
In the last part of the essay the effect of the most interesting opportunities will be economically estimate using adequate measure units but having in mind the need for a sure gross margin of the farm economy, what means low variable costs, and a good gross profit, what means using the natural environment as much as it is possible.

RESULTS AND DISSCUSSION

Biodiversity in sheep

Among the domesticated animal genetic species, sheep is the one giving the most diversified kind of goods [6].
Sheep are producing wool, at list three kinds of wool related to the fiber diameter: thin wool (< 24μ), meddle wool (28μ – 33μ) and thick wool (> 37μ). There is also white wool and colored wool. Related to the wool production there are breeds covered with the denomination of Merino Sheep. The most famous breed is the Australian Merino. A preserved old breed is the Rambouilet Merino, in France. There are also Merino breeds in Spain (as native breeds), in some European countries including Romania, in Russia, in other countries having dry climate.
Unfortunately wool is not enough appreciated, now days, except in Australia. That means there is no desire to increase wool production in other countries.
Sheep are producing meat. There are at least three kinds of sheep meat. The Mouton, what is a lean meat obtained mostly from young animals grown up to 30 -35 kg of body weight. This kind is required in Western European counties and other countries undertaken English influence. Countries having dry climate and low vegetables' production, like Arabian countries or Mongolia prefer a fat mutton containing vitamins in their suet. There countries, like Romania, for instance, that consume sucking lambs.
In case of mutton production there is interest for more meaty carcasses from some local ewes, for faster growing lambs and for more sucking lambs to be slaughtered.
For good mutton English breed like Southdown, Suffolk, Romney Marsh, Lincoln, Leicester, Border Leicester and so on are appreciated. For fat carcasses the Romanian local breeds Tsurcana and Tsigaia are very good.
Milk production is desired especially in the undeveloped countries where the extensive farming is in use. Thus good mobility of ewes is appreciated and has to be preserved. There is much need of labor in production of milk. Nevertheless in intensive farming two specialized sheep breeds for milk production are in vogue. The Friesian breed, in Netherland, is created for a humid climate and Awassy, in Israel, is created for a dry climate.
Pelts from very young lambs are much appreciated. There are two kinds of wanted pelts. Karakul pelts on ringed fibers and "mouton d'aure' "pelts prepared from young lambs skin of different middle fiber wool sheep. For this purpose large new born lambs are desired.
Skins of adult sheep are also wanted for covers or fur coats. A special quality is offered by the skin of Romanov sheep breed whose coat has shorter thick fibers and little longer thin ones. Such kind of skin is much appreciated in fur cups' manufacture. This kind of fur isn't possible to have for other breeds or crosses.

Some reproduction particularities in ewes

Sexual activity in ewes is under photoperiodic influence. Increasing of dark part of day has cumulative effect in stimulating and liberation of gonadotrophic hormones from the pituitary gland [2] [6]. That is due to the natural selection acting in formatting of *Ovis* genetic species that synchronized the mother ewes' needs of food to the growth intensity of herbs. This trait was saved in domesticated sheep since the outdoor farming system has been practiced along the times. Par consequence the

inter lambing interval is formatted from the mating season of some estrus cycles, the pregnancy of 5 months standard length, the suckling period when young lambs are fed on milk, a milking period if the ewes are milked and a seasonal anestrous before the next mating season (Fig. 1).

The anestrus is due to the photoperiodism. In addition it is sustained by the presence of lambs so long they are sucking [9].

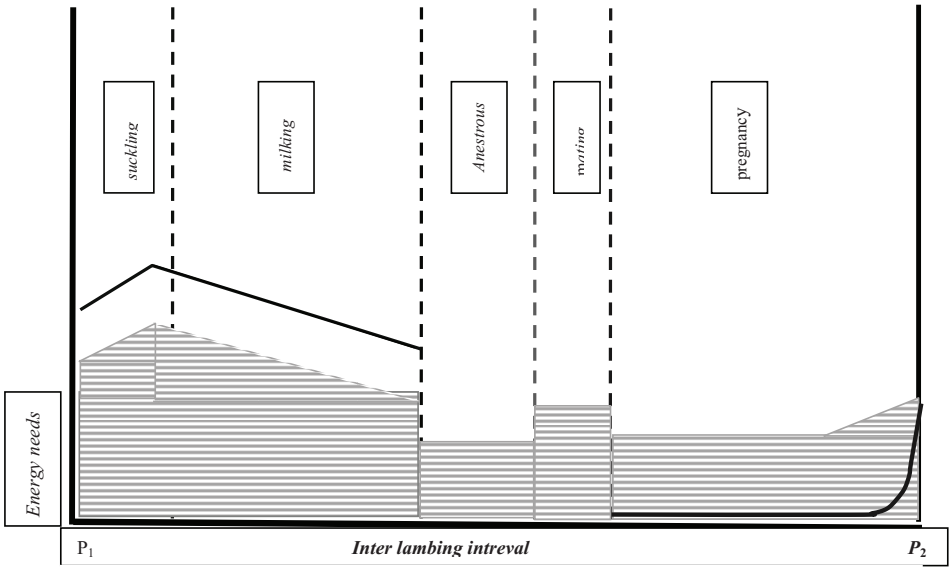

Fig. 1. Components of the inter lambing interval in ewes (after M. Paraschivescu)

Two parameters are genetically determined the 148 – 150 days as length of the pregnancy and 17 days as length of the estrus cycle. Under farming condition the mating season in some breeds is longer than it is in local breeds...Uzualy one folicule is dehiscent in a natural estrus cycle but there are some breeds with frequent gemelarity. In extensive farming the first mating is taking place in the second year of life. In the intensive farming the first lambing is moved in the first year of life.

Essential reproduction biotechnologies in ewes

Many experiments concerning reproduction biotechnologies in farm animals started with ewes [4]. Currently there is rich knowledge about artificial insemination in sheep. Long term preservation of semen is ensured by freezing. Last progress concerning ova fertilization was done by intrauterine insemination of semen especially when deep frozen semen is used [3].

Estrus synchronization both in mating season and out of mating season is solved braking the estrus cycle in diestrus in case of the sexual season by progesterone in the sexual season or by a complete substitute hormonal treatment out of season [5]. Thus blind artificial insemination can be applied for entire flock at the same time.

Super ovulation is controlled as well using FSH of ovine or porcine origin in three days before proestrus or with one dozes of 350 IU of PMSGn immediately before proestrus [7]. Proestrus is obtained when controlled diestrus is deblocate or at the end of a complete substitute hormonal treatment when the action is provided out of the mating season.

Multiple ovulation in sense of collecting embryos by repeating super ovulation is provided only once at the next estrus cycle after

embryo washing. That could be explained by the little number of ovarian cycles during the sexual season or may be because before embryos are collected surgically [3].

Long term conservation of embryo by freezing is a solved question. The lent (English method) freezing, the rapid freezing and the vitrification freezing are applied with satisfactory results. The most used crioprotector is glycerin [11].

The success rate of embryo transfer goes up to 60%. Ruther successful attempts have been made to have twins from receptors females [11].

Better results are wanted concerning the fertilization rate of super ovulated ova in order to increase the number of transferable embryos before freezing them. Better synchronization of the gynecological state of receptor ewes with the age of the transferred embryos is also desired.

Important results have been obtained with in vitro fertilization (IVF) [11]. On this basis transgenic organisms carrying foreign DNA have been obtained. This is a very important fact for pharmaceutics industry.

Cloning of sheep organism was successfully provided. We have to remember the famous Dolly case. Now is said some hundreds of clones of Dolly's type have been obtained. In this case clones have been obtained from adult somatic cells, but clones can be obtained from embryonic cells, too. Hopes for the future are connected to improving de endoscope technique of collecting embryos in order to save the life of genetically valuable donors.

There are also hopes to increase the fertilization rate of super ovulated ova by improving the inseminated spermatozoa capacitating. Many hopes are related to the frequency of twins or triplets obtained from the receptors ewes, associated to small number of transfer embryos' lost. Of great importance for the pharmaceutical. Al of these hopes aims to decrease the cost of applied MOET in selection or in commercial flocks.

Disclosing undemonstrative spare outputs by reproduction biotechnologies in sheep

The target of disclosing undemonstrative spare outputs by reproduction biotechnologies in sheep is very complex because of the great number of possible biotechnologies that could be used and the high diversity of possible targets to be attained.

To pass over difficulties we will make an attempt to classify the main fields reproduction biotechnologies to be applied and to appreciate their specificity. The main fields are:

a) to determine *genetic progress* of the breeding stock of pedigree animals selected to conceive in closed reproduction the new generations of pedigree animals of one sheep breed;

b) to improve the quality or to increase the quantity of products from a sheep flock with commercial purpose;

c) to multiply transgenic organisms by cloning them from adult somatic cells;

d) to preserve "*ex situ*" breeds in critical state of extinction.

Better *genetic progress* can be obtained with higher selection intensity or with higher precision of selection. Higher selection intensity is possible when individual fertility is increased. Precision of selection is the best when progeny' performances are considered versus self performances' test, or sibs' and ancestors' test of performances are used. Artificial insemination is able to highly increase the fertility of rams [6] . Thus AI permits to select with higher precision the best son of a ram when the selection criterion is appreciated on the sons and before they have to be at puberty. This is the case of mutton breeds, of thin or middle wool breeds or even of Karakul pelt breed. For traits that cannot be appreciated on rams, the case of milk production where the minim numbers of 30 pairs daughter – contemporary are required the AI become necessary. But using or not using the artificial insemination is a question of costs. Since AI is not expensive, it might be used to know the genetic abilities of rams in all flocks of excellence. Very interesting discoveries could be done concerning the genotype of rams in Karakul flocks producing pelts of different colors. Thus pelts of wanted colors could be obtained at will not by hazard.

Using ET or other associated to ET technologies in order to increase selection intensity for genetic progress seems to be too expensive for such purpose.

To produce more for the market or to produce more valuable products from the same flock is the goal of any shepherd. AI can help a shepherd possessing of Tsurcana breed producing low growing lambs and fat carcasses when adults to have better lambs to be sold at about 6 month of age for mutton. That is very simple all the flock when first in heat is artificially inseminated and after artificial insemination rams of the flock breed will be left free in the flock for natural mating. It is estimated that approximately 50% of the ewes will be pregnant from AI and the other 50% of ewes will became pregnant with rams of the local breed. Further the first born lambs, of both sexes, will be grown for mutton and the last lambs will be sold for slaughter as sucking lams if males and will be kept in the flock to replace the old females [4].

The same procedure could be applied in case of ET. Then the wall flock is synchronized as receptors of embryos of mutton breeds. Half of them will deliver mutton lambs and the other will deliver males to be slaughter and females to be kept for completing the flock. This time the commercial value of mutton lambs will be higher [11].

Other schemes with ET are applicable as well. Let's say a shepherd has an Awassy flock and he is interested to sell more milk [8]. If he transfer to the al ewes in the flock 1 karakul embryo and half of them became pregnant the other half of the flock will became pregnant with Awassy rams left free in the flock after ET. Out of these naturally mated ewes will be born females equivalent to about 25% of the number of ewes in the flock. That is enough to maintain the size of the flock if the necessity culling of ewes allows a mean production life of 4 years per ewe. That means that about half of the ewes will bore one

Karakul lamb slaughtered for its pellet at three or less days of age. Thus these ewes will have a longer milking period based on the beginning of lactation when the daily milk production is more. In this case the shepherded win the value of the pelts and the value of the plus o milk from the first about 45 days of lactation. It is for sure that the sum of the goods motioned before depasses the costs of the embriotransfer.

The same scheme applied in a Karabasha flock could allow to tray to transfer two embryos to each receptor ewe. There is a chance to have twins of usual size since Karabasha ewe is known to give heavy lambs.

Or what is if in Karabasha sheep two Karabasha embryos are transferred 7 days after ewes were matted. Then it is possible to have a double prolificacy of the flock resulting from single double and triple parturitions. That also will value more than the costs of the embryo-transfer.

If the life of donors is saved when the embryo are washed, that will reduce the embryo transfer costs, then more opportunities are opened in applying reproduction biotechnologies in sheep. In this case production of embryos has to be concentrated out of mating season of ewes.

In vitro fertilization is the biotechnology permitting to access the ova or the zygote before ova fertilization. That allows sequences of foreign genetic species of DNA to be transferred in sheep embryos. The DNA sequence transferred command syntheses of a protein of interest. Usually the transgenesis success is recognized by the presence of transferred genes in the milk of genetically modified organism obtained. Cloning of superior animals from adult cells give the possibility to reproduce transgenic organisms without sexual reproduction, a very important fact for pharmaceutical industry.

Finally the *"ex situ"* preservation of populations in critical states of extinction while they have less than 100 individuals' contingency, is based of deep freezing of semen or embryos. Of course embryos must be preferred since they dispose of complete genetically information.

CONCLUSIONS

Estimating the undemonstrative spare outputs of sheep breeding disclosed by reproduction biotechnologies in sheep breeding pretends much imagination because of the multitude of known procedures and because of diversity of products obtained from sheep flocks.

The main sources of added outputs are a higher fertility of ewes from induced by super

ovulation gemmelarity, eventually associated with higher commercial value of new born lambs, or by producing and saving embryos during the long anestrous between two pregnancies.

Of great importance is creating by transgenesis GMOs for pharmaceutical purposes and to reproduce them by cloning from somatic adult cells.

Some difficulties in developing reproduction biotechnologies with ewes result from the ruther small body size of animals. It is possible to pass over these difficulties with good endoscopic equipment.

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REFERENCES

[1] Armstrong D.T.; Evans G., 1983. *Factors influencing success of embryo transfer in sheep and goats*. Theriogenology 19, pag.31 – 42,

[2] Bogdan A.T. şi colab., 1983. *Reproducţia animalelor de fermă*. Editura Scrisul Românesc, Craiova pag. 104-108.

[3] Flores-Foxworth G.; McBride B.M.; Kraemer D.C.; Nuti L.C., 1992. *A comparison between laparoscopic and transcervical embryo collection and transfer in goats*. Theriogenology 37,

[4] Cseh S.; Seregi J., 1993. *Practical experiences with sheep embryo transfer*. Theriogenology 39,

[5] Oţel V., Harşian A., Paraschivescu M., 1965. *Cercetări privind sincronizarea estrusului la ovine.* Lucrări Ştiinţifice ICZ vol. XXI

[6] Paraschivescu M., 1969. *Reproducţia la ovine*. Editura Agro – Silvică Bucureşti. pag.45-80.

[7] Paraschivescu M., Ursescu Al., 1966. *Influenţarea vieţii sexuale la ovine în sezonul de primăvară prin tratamente hormonale*. Lucrările Congresului Internaţional de Biologie a Reproducţiei, Moscova.

[8] Tobă G.F., A.T. Bogdan, M. Th. Paraschivescu, L.G. Tobă, Maria Vasile, Gh. Neaţă, 2011. *Utilizarea biotehnologiei însămânţărilor artificiale, la ovinele din rasa Ţigaie Capnegru de Teleorman (Karabaşă), utilizând material seminal congelat din rasa Awassi din Siria, în scopul dezvoltării şi conservării biodiversităţii ovinelor*. Simpozionul cu tema: „Contribuţii ale cercetării ştiinţifice la progresul medicinii veterinare" F.M.V. – Bucureşti

[9] Voicu Rita, Paraschivescu M., Ghiţă Elena, Radu R., Jitaru Daniela, 1996. *Influenţa duratei perioadei de muls asupra producţiei de lapte la ovine*. Anale IBNA vol. XVIII.

[10] Zamfirescu Stela, Şonea Al., 2004. *Biotehnologii de Reproducere la Rumegătoarele Mici*. Editura Exponto, Constanţa pag 30-64.

[11]*** 1998. *International Embryo Transfer Society*. pag.106-107 in Manual of the International Embryo Transfer Society (D.A. Stringfellow and S.M. Seidel, ed.), IETS, Champaign, IL, USA.