Scientific Papers. Series D. Animal Science. Vol. LXIV, No. 1, 2021
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

METHODS AND TECHNOLOGIES USED TO INCREASE THE PROLIFICACY OF LOCAL SHEEP BREEDS

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Abstract

The orientation of the breeding and exploitation of sheep for meat production worldwide, imposed a basic technological element, namely obtaining as many lambs as possible, which is the most important goal in increasing this production. The increase of the reproduction indices creates the premise of the profitability of the sheep regardless of the exploitation system practiced. The interest is channeled especially for the increase of fecundity, fertility, and especially prolificacy indices. The intensification of prolificacy is a major objective in the exploitation of all breeds of sheep because it leads to the numerical increase of livestock and meat production. Twin lambs have intense growth energy, which allows the weight of the simple ones to be equalized until the age of the first shearing, and the expenses occasioned by the maintenance of the second lamb are generally reduced. Most of the sheep breeds that are raised in our country are characterized by fairly low values of prolificacy (105-110%), the highest value being recorded in the Merinos de Palas breed. Prolificacy is dependent on genetic factors, especially on the breed. Reproductive characters are characterized, unfortunately, by a low value of the heritability coefficient (h^2 = 0.05-0.25), which is determined mainly by non-additive genes, so the selection for this type of characters is very difficult and long-term, the fastest way to improve prolificacy in local sheep breeds is by crossing them with rams from prolific breeds. Internally, within the I.C.D.C.O.C - Palas Constanta, the Prolific Line - Palas was created, following the crossing of Merino de Palas sheep with rams from Romanov, Friesian, and Finnish Landrace breeds, which are characterized by an average prolificacy of 160-180%. Prolific breeds can be used in simple industrial crossings to increase meat production (females prolific breeds x males meat breeds), or to obtain F1 hybrid prolific females in the year I (local breed females x males prolific breeds), which in the second year are crossed with males from specialized meat breeds (double or triple industrial crossings).

Key words*: crossbreeding, local breeds, meat breeds, prolificacy, reproduction indices, selection.*

INTRODUCTION

Sheep breeding and exploitation is an ancient activity, with great traditions in Romania, it is a basic branch of animal husbandry that has developed in different pedoclimatic areas, depending on the biological characteristics of the breeds exploited and market requirements (Ștefănescu et al., 1973).

At the national level, the reconsideration of the directions of sheep exploitation and the orientation of the activity of breeding this species on the principles of the market economy stimulated the preoccupations for the increase of milk and meat productions. In this context, even if wool production is no longer a priority in the current conditions, by ensuring a quantitative level, but especially its quality in the breeds and populations specialized for milk and meat can obviously ensure an additional income of farmers and capitalization efficient use of this textile raw material with special physical-mechanical, technological and hygienic properties (Taftă, 1997).

The concerns of sheep breeders must be directed towards increasing and improving the quality of meat in sheep and for increasing the quantity of milk, this can be achieved by creating breeds, populations and lines of specialized sheep for meat or milk production, without neglecting wool production, simultaneously with the application of selection to existing breeds in Romania and by improving growth and exploitation technologies (Pădeanu & Voia, 2010).

Establishing the relationship between the different productions and the limits between which they can increase, without prejudicing the physiological balance, is the problem of major practical significance, in order to increase the profitability in the field of sheep breeding. There is no physiological antagonism between wool production, meat production and milk production, but on the contrary a reduced positive phenotypic correlation, however, even under very good care and feeding conditions, wool production, meat production and milk production can't be raised in parallel, indefinitely (Taftă, 2008).

Sheep farming has been and remains an important goal, as this species can use less used feed as food and housing and care needs are less expensive than other species (Călin, 2003).

Assisted reproduction, shortening the calving-breeding period, deseasonalization of heat and calving and accelerating calving by non-hormonal and hormonal methods, can successfully contribute to both calving per year, three calving in two years, and increasing the prolificity of sheep (Răducuță, 2000).

The success of theapplication of these biotechnological methods will be possible only where there is a sustained concern for the correct application of all technical and biotechnological stages that can be achieved by obtaining outstanding results in increasing the birth and prolificity of sheep and obtaining offspring with superior morphoproductive traits. to justify the effort to disseminate knowledge to the breeder on the introduction and expansion of biotechnological methods of reproduction.

The problem of intensifying reproduction in sheep by reducing the interval between calvings is a concern both nationally and globally (Dărăban, 2016).

The reproductive capacity of sheep is one of the main factors that determine the multiplication and improvement of livestock, which is why we consider that the chosen topic is current.

Lately, the growing needs for products of animal origin and especially food have naturally led to a reconsideration of the old systems of breeding and exploitation of animals, including sheep, being replaced by industrial systems.

As already shown, in recent years the breeding of sheep in our country has acquired new guidelines that give sheep production a much more pronounced character of intensity than it had in the classic system of breeding and exploitation.

Currently, sheep farming is increasingly oriented towards meat production, which will become the main production in some areas of the country in the near future. Increasing the production of sheep meat and increasing the economic efficiency of this activity are largely conditioned by the intensification of the breeding process.

The orientation of the breeding and exploitation of sheep for meat production worldwide, imposed a basic technological element, namely the intensification of the breeding process, as obtaining as many lambs as possible, is the most important goal in increasing this production (Taftă, 1983).

Reproduction intensification includes a series of measures and methods whose main purpose is to transform seasonal polycyclicity into annual polycyclicity, facilitating the installation of gestation, including in the anestrus phase, as well as advancing the age of the first mount from 18 months to approx. 8-10 months, which will allow to increase the prolificacy, the possibility of organizing calvings throughout the year and obtaining a number of 1-2 lambs every 7-8 months (Răducuță, 2000).

Research conducted worldwide and nationally in the field of sheep breeding has shown that the reproductive function can be modified and directed to advance estrus and even the manifestation of heat throughout the year, within physiological limits, provided certain feeding conditions and maintenance (Taftă et al., 1997).

The study of the physiological characteristics of reproduction showed that the process of reproduction in animals is suitable for a scientific direction and regulation, the sheep being - among the domestic species - the most receptive to the stimulation of sexual activity.

MATERIALS AND METHODS

In order to create this material, the following bibliographic materials were studied: specialized books on the reproduction of domestic

animals or sheep breeding, represented either by unique textbooks specific to the profile faculties in our country, or by specialized textbooks, specialized brochures, specialized courses, papers presented at various national and international symposia.
The methodology of the paper consisted in presenting the prolificacy index (definition, calculation relationship and influencing factors), presenting the methods and technologies used so far to increase prolificacy in sheep in our country, along with the results obtained in scientific research by profile, and finally the presentation of the conclusions arising from the researched material.

RESULTS AND DISCUSSIONS

The *prolificacy* in sheep varies within quite wide limits, being determined by internal and external factors (breed, age, breeding season, food, hormonal substances, etc.). In terms of prolificacy, sheep are located between uniparous and multiparous species.
Prolificacy is calculated by relationship (Paraschivescu, 1969):

$$P\% = \frac{100*m}{f}$$

In wich:
p = prolificacy;
m = number of lambs;
f = number of births.

In some sheep breeds, the prolificacy is very high, even constituting a breed character (Finnish Landrace, Romanov, Oldenburg, Friesland, Border-Leicester, Chios, Hu-Yang, etc.).
The percentage of prolificacy obtained in the sheep from the resorts of the former Institute of Zootechnical Research is shown in Table1.

Table 1. Fertility and prolificity of local breeds (Taftă, 1983; 1997)

Race	Fecundity (%)	Prolificacy (%)
Merinos de Palas	93	110-146
Merionos de Transylvania	93	112-120
Spancă	95	110-116
Țigaie	97	104-107
Țurcană	98	103-105
Karakul	97	105-108

Prolificity is dependent on genetic factors, but is also influenced by environmental conditions, may have its own innate character or can be acquired through various biological or genetic interventions.
In order to increase the prolificacy, in our sheep farms the selection of breeders from twin calvings, the preparation of sheep and rams for breeding, their rational feeding during the breeding period as well as the pregnant sheep, the hormonal method, the crossing with prolific breeds to enrich the gene pool are applied. with the valuable genes of these breeds, especially for obtaining lambs for fattening.

Factors influencing prolificacy. Prolificacy is dependent on several genetic factors (breed, population and individual) and the environment (diet, hormonal treatments, age of sheep, weight of sheep, breeding season), which can be controlled by sheep breeders (Bogdan et al., 1984).
The breed has a major influence, as there are highly specialized breeds in the direction of prolificacy such as: Bluefaced Leicester 180-200%, Frisian 200-225%, British Sheep Dairy 220-300%, Romanov 250-300%, Hu Yank 200-300%, Finnish Landrace 300%. Specialized breeds from other countries are more than twice as prolific as indigenous sheep breeds (Răducuță et Tăpăloagă, 2010).
In Romanov, the reproductive character represented by fertility and prolificacy is higher than 250%, while in other breeds (Țurcană, Țigaie, Karakul de Botoșani) the prolificacy tends to be very close to 110% (Pascal, 2015).
Population and individual. Within each race there are populations and within them, individuals with a much greater prolificacy. The selection is based on individual variability in order to be able to achieve populations with high prolificacy (Pădeanu, 2012).
Food. Feeds rich in essential amino acids, energy, vitamins and minerals and with a moderate content of phytoestrogens cause the simultaneous maturation of 2-5 ovarian follicles. In order to obtain a high prolificacy, it is necessary to maintain the level of stimulating nutrition both during the breeding campaign and in the first month of gestation, in order to avoid embryonic losses. In the autumn season, during the period of preparation for breeding

and breeding, as well as in the first month of gestation, it is recommended to graze on green stubble (clover, alfalfa, pastures grown in a mixture of legumes and grasses, peas, oats, wheat, barley) or on meadows poisoned alternately with pastures rich in carbohydrates (corn stubble) (Pădeanu, 2012; Stoica, 1994; 1997). Through these measures a prolificacy can be achieved at least at the upper limit of the breed.

The age of the sheep significantly influences the prolificacy, being lower in sheep, then it increases until the age of 5-6 years, when it is maximum, after which it decreases with advancing age. In the growing female youth, a large part of the nutrients is still directed towards the development of the body, and in the elderly sheep the efficiency of digestion and metabolism decreases in parallel with the increasing incidence of gynecological diseases. In relation to age, research conducted at ICPCOC - Palas established that the prolificacy is lower in primiparous sheep, increases up to 5-6 years (137-140%), then gradually decreases to 116.6% at the age of 8 years (Scheul et Petcu, 1975; Sandu, 1993).

The body weight of the sheep shows a moderate influence on the prolificacy, in the sense that the heavier sheep perform a significantly higher number of multiple calvings compared to the sheep with lower weight. Body weight positively influences the prolificacy, finding that Merino de Palas sheep with a body weight between 66-80 kg, register the highest value, respectively 131-139%, while sheep with a weight of 61-65 kg, have a prolificacy of only 126% (Bogdan et al., 1984; Taftă, 1983). However, the improvement of sheep for prolificacy does not go in the direction of increasing body weight, as this would entail additional costs with the maintenance of those sheep.

The breeding season has an indirect influence on prolificacy through the level of feeding, the length of daylight and the intensity of light.

Frequently, the highest prolificacy is achieved in sheep breeds in our country in the autumn season, when sheep benefit from abundant forage, moderate brightness (1: 1). After the breeding done in the first part of the breeding season, the most multiple births are obtained for the native sheep breeds (Pădeanu, 2012).

Methods and technologies used to increase prolificacy. To increase prolificacy, in our sheep farms we apply the selection, preparation of sheep and rams for breeding and rational feeding during the breeding period as well as pregnant sheep, hormonal method, crossing with prolific breeds to enrich the gene pool with the valuable genes of these breeds, especially for obtaining lambs for fattening.

Selection to increase prolificacy. The ability to give birth to several lambs at birth varies between breeds and between individuals, due to the different number of eggs which is dependent on the special concentration of blood in gonado stimulating hormones. (Ștefănescu et al., 1973).

Reproductive characters are unfortunately characterized by a low value of the heritability coefficient (h^2 = 0.05-0.25), being determined mainly by non-additive genes, so the selection for this type of characters is very difficult and long duration, the fastest breeding route being the breeding of rams of the prolific breeds (Mochnacs et al., 1978).

It should be noted, however, that in the hereditary transmission of prolificacy females participate with about 3/4, respectively in a proportion of 75%, while males only with ¼ (Taftă, 1983).

Also, the existence of differences by race, lineage and family in terms of multiple calvings, is a guarantee that increased genetic proliferation and birth rate is possible and that the selection made for such characters will get an answer at an acceptable rate, despite the coefficients of reduced heritability, if the choice of individuals to produce the next generation is made after several production cycles, and the rams are tested for offspring and collaterals (Bradford et al., 1981).

Retention for hatching of males and females from twin births can be a great way to identify future mothers and rams that have a favorable genetic potential for increasing fertility and prolificacy (Taftă, 2008).

At the same time, the practice of an indirect selection by characters associated with prolificacy, such as body weight (Table 2), milk production (rG = 0.13-0.16), skin reserves, degree of coverage of the face with wool, rate of ovulation and scrotal

circumference, can lead to encouraging results (Bodin et al., 1999).

Table 2. Genetic correlation between prolificacy and weight at different ages (Analla et al., 1995)

Genetic correlation	Prolificity - birth weight	Prolificity - weaning weight	Prolificity - weight at 90 days	Prolificity- weight at 180 days
rG	0.18	0.48	0.36	0.22

However, the selection and breeding of sheep with a genetically enhanced character for twin births can be used as one of the ways to raise prolificacy, especially in our country where prolific breeds are lacking.

Food. Another method of influencing prolificacy has been shown to be nutrition. Feeding experiments have shown that sheep have in their genofond the capacity to produce a greater number of lambs, a genetic possibility that can be enhanced by the use of favorable environmental factors, especially through adequate feeding of sheep in the breeding season. reproduction and during pregnancy. Selection associated with optimal feeding and care conditions can be used to increase prolificacy. In 1970, at the I.C.D.C.O.C - Palas, a group of Merino sheep with double and triple births began to be selected, which were mated with rams from twin births, in order to create a prolific line (Florea, 2018).

The quality and level of the ration administered to the sheep in the period before the start of the breeding season is also of considerable importance. Research in this regard has shown that if at that stage, feeding is done using balanced rations, after breeding will be obtained not only an increase in the number and weight of lambs born but also a higher percentage of twin births, so stimulant feeding. it also induces an increase in prolificacy (Pascal, 2015). This stimulating feeding procedure is known as flushing. Particular attention should also be paid to the mineral supplement and vitamins.

The supplementation of the ration applied during the preparation period for breeding, therefore leads to obtaining beneficial effects in increasing the prolificacy. Following the research, it was found that the application of this method (flushing) for a period of only two weeks, increases the number of twin births from 6-8% to approx. 20%, and when applied for 4-5 weeks the twin births reaches to 40% (Tafta et al., 1997). In general, a good preparation of sheep for reproduction on the basis of green mass, in sufficient quantity and of good quality, leads to higher fertility and prolificacy.

Crossing. The main method of increasing prolificacy in sheep is cross-breeding with rams of the prolific breeds, which is widely applied in many countries (Russia, USA, New Zealand, England), in order to produce an increased number of lambs for fattening (Ștefănescu et al., 1973).

In our country, a series of experiences were organized within the I.C.D.C.O.C - Palas Constanța for crossing local sheep with rams of prolific breeds, which highlighted the fact that the F_1 crossbreeds obtained had a much higher prolificacy than the local breeds (Table 3).

Table 3. The effect of sheep hybridization for prolificacy (Ionescu et al., 1985)

Sheep breeds	Average prolificacy, %	
	Maternal breed	Metis F_1
Romanov x Merinos de Palas	127.3	196.9
Romanov x Spanca	135.7	170.3
Romanov x Turcana	102.9	164.7
Finnish Landrace x Merinos de Palas	127.3	163.3
Finnish Landrace x Spanca	135.7	170.7
Finnish Landrace x Tigaie	111.3	180.0

In general, the purpose of crossing sheep of less prolific breeds with rams of breeds that have this pronounced trait is to obtain F_1 females with hereditary substrate enriched with genes for prolificacy. Crossbred females are then crossed with rams of the meat breeds to obtain an increased number of lambs for meat.

In France, Romanov is preferred as a prolific breed due to its high prolificacy (250%), long breeding season (8 months/year), excellent fertility, strong maternal behavior and good product viability, while in England Finnish Landrace and Border-Leicester breeds are preferred, approx. 35% of the sheep livestocks in these countries are bred by crossbreeding (Bonnes et al., 1991).

In our country were imported rams of the Border-Leicester breed, characterized by a good prolificacy. These rams have been crossed

with sheep of our breeds and types to produce prolific mixed breed sheep to be crossed with rams of meat breeds (Ile de France, Suffolk). Such an experiment was carried out at I.C.D.C.O.C - Palas, where 84 F1 ewe lambs (Border Leicester x Spanca) were crossed during 1972 with meat rams (Florea, 2018).

Lately, the researchers attention is directed towards the creation of synthetic (composite) populations, resulting from the crossing of 3-4 breeds, thus combining the prolificacy of some breeds recognized in this respect, with breeds that have an extended reproduction duration on the whole year (e.g. 50% Finnish Landrace + 25% Dorsethorn + 25% Rambouillet), or with breeds that have a high growth intensity (e.g. 50% Finnish Landrace + 25% Suffolk + 25% Targhee), which creates the possibility of maximizing the intensity of selection and maintenance of heterosis at high values for several generations (Taftă et al., 1997).

Internally, within the I.C.D.C.O.C Palas, the Prolific Line - Palas was created, following the crossing of Merino sheep with rams of the Romanov and Finnish Landrace breeds, which is characterized by an average prolificacy of 160-180% (Taftă, 1998).

Recently, in the ADER 5.1.2. Project, good results regarding prolificacy were obtained for local sheep breeds by crossing them with the prolific breeds (Romanov x Merionos de Palas), obtaining in F1 hybrid sheep an average prolificacy of about 160%, compared to the Merinos de Palas breed where the prolificacy was 105% (MADR - Proiect ADER 5.1.2).

Increased prolificacy can also be achieved by the introgression of a major gene (F/F and F/+ fertility gene), as is the case of the Booroola, Galway, Toka, Olkuska genes, which can increase the frequency of twin births in a non-proliferative population, being in fact among the latest achievements of science in this field (Bodin et al.,1999).

Hormonal method. This involves the use of estrogen hormones such as S.I.G. to increase the number of lambs at birth, using at the same time with the synchronization of estrus**.**

Hormone treatment aims to provoke twin births or stimulate the appearance of estrus in the off-season to obtain two births in one year or three births in two years. Regarding the first aspect, some of the results obtained in our country and in other countries, as well as the prospects of application in large production, were previously shown. Thus, it was concluded that the challenge of poliovulation has more chances of application in production, in association with the synchronization of estrus in the normal breeding season. The orientation of sheep breeding towards meat production has also raised in our country, lately, the problem of synchronous induction of estrus in the off-season and scientific research indicates convenient solutions in this regard (Ștefănescu et al., 1973).

Numerous researches have been carried out both globally and in our country, using as sexually active substances serum gonadotrophins in the form of S.I.G., alone or in combination with progesterone, as well as similar synthetic preparations, administered in different ways: per os, subcutaneous injections, intravaginal weights, and more recently in the form of implants.

Timariu et al. (1961), using progesterone injections and S.I.G. in the months of April-May in Merino de Palas ewes who gave birth in January obtained a fecundity of 68% and a prolificacy of 140%.

Hormone treatments are an effective method, available to sheep breeders. In most cases, hormonal treatments for heat synchronization also aim to increase prolificacy, so the dose of PMSG will increase, in this case, by about 20-30% (compared to 500 IU PMSG, 600-700 IU PMSG is inoculated). At present, in France, most sheep farms for milk and meat undergo hormonal treatments, which aim to synchronize heat and increase prolificacy (Pădeanu, 2012).

From the conclusions drawn from these experiments, it emerged that in sheep breeding there are great possibilities to increase the prolificacy by the hormonal method, but the scope is still limited in our sheep farms, being related to its laborious nature.

In addition, hormonal treatment involves the early and very early weaning of lambs, especially when it comes to producing two births a year. Feeding these lambs with milk substitutes or with proper starters and starters also raises a number of issues in terms of ease of application in large production.

From the above, it results that in sheep breeding there are great possibilities to

intensify reproduction both by using genetic methods and by directing external factors.

CONCLUSIONS

From the presented material, it appears that the prolificacy of local sheep breeds is still at a very low level. Over time, a number of methods have been used in our country to increase the prolificacy of local sheep breeds.
Direct or indirect selection for prolificacy associated with optimal breeding and care conditions can be a way to increase prolificacy. The main and fastest method of increasing prolificacy, however, is the crossing of local breeds of sheep with prolific rams.

REFERENCES

Analla, M., Muñoz-Serrano, A., & Cruz, J.M. (1995). Estimation of genetic parameters of growth traits in Segureña lambs. *Journal of Animal Breeding and Genetics*, 112(1-6), 183-190.

Bodin, L. et al. (1999). *Reproductive genetics in ruminants. Productions animals,* Vol. 2. Paris, FR: INRA Publishing House.

Bogdan, A.T. et al. (1984). *Fertility, birth rate and prolificacy in animal husbandry*. Cluj-Napoca, RO: Dacia Publishing House.

Bonnes et al. (1991). *Genetic improvement of farm animals.* Paris, FR: Feucher Editions.

Bradford, G.E., Torell, D.T., Lasslo, L., & Neira, R. (1981). Selection for growth and reproduction in Targhee is sheep. *Sheep and Wool Days, Special Report*, 613, 42-55. Oregon State University, Corvallis, USA.

Călin, I. (2003). *Sheep and goat breeding technology.* Sibiu, RO: "Lucian Blaga" University Publishing House.

Dărăban, S. (2016). *Raising sheep and goats - Teaching manual*. sem II, Cluj-Napoca, RO: Risoprint Publishing House.

Florea, A. M. (2018). *Research on the identification of economic ways to manage the sexual cycle in Karakul de Botoşani sheep in order to increase production and reproduction performance*. Ph.D. Thesis, UASVM Iasi.

Ionescu, A., Ursescu, A., & Vicovan, G. (1985). Study on the use of hybridization to increase and improve sheep production. *Scientific papers I.C.P.C.O.C. Palas*, Constanta, Vol. 3.

MADR, Project ADER 5.1.2 (2015-2018). *Efficiency of family farms with Merino sheep by increasing the prolificacy and increasing the quality of products according to the requirements of the EU market.* I.C.D.C.O.C - Palas Constanta, RO.

Mochnacs, M., Taftă, V., & Vintilă, I. (1978). *Genetics and breeding of sheep*. Bucharest, RO: Ceres Publishing House.

Pădeanu, I., & Voia, S.O. (2010). *Sheep and goat breeding technology*. Timisoara, RO: Eurobit Publishing House.

Pădeanu, I. (2012). The proliferation of sheep severely affects the efficiency of sheep farms. *Farm Magazine* (https://www.revistaferma.ro/articole/zootehnie/prolificitatea-oilor-conditioneaza-sever-eficienta-fermelor-de-ovine).

Paraschivescu, M. (1969). *Sheep reproduction.* Bucharest, RO: Agrosilvica Publishing House.

Pascal, C. (2015). *Treated for raising sheep and goats*. Iasi, RO: "Ion Ionescu de la Brad" Publishing House.

Răducuță, I. (2000). *Comparative research on fattening Merinos sheep with different rations.* Ph.D. Thesis, UASVM Bucharest.

Răducuță, I., & Tăpăloagă, D. (2010). The advantages of using the Romanov sheep breed in Romania. *Romanian Farmer Magazine*, 5, 15-17.

Sandu, G. (1993). *Sheep exploitation engineering.* Bucharest, RO: Alutus-D Publishing House.

Scheul, V., & Petcu, D. (1975). Ways to intensify reproduction in sheep. *Scientific papers I.C.P.C.O.C. Palas*, Constanta, 2, 65-69.

Ștefănescu, C., Ciolcă, N., & Taftă, V. (1973). *Romanian Animal Husbandry.* Vol. III - Sheep, Academy Publishing House.

Stoica, I. (1994). *Animal nutrition. Norms and nutritional values.* USAMV Bucharest, RO.

Stoica, I. (1997). *Animal nutrition and alimentation*. Bucharest, RO: Coral Sanivet Publishing House.

Taftă, V. (1983). *Intensive breeding and exploitation of sheep.* Bucharest, RO: Ceres Publishing House.

Taftă, V. (1998). *Tehnology for evaluation of productive performance in sheep.* Bucharest, RO: Ceres Publishing House.

Taftă, V. (1997). Again about the need to grow Merinos in the plain area. *Revue of Animal Husbandry and Veterinary Medicine,* Nr. 7-8.

Taftă, V., Vintilă, I., & Zamfirescu, S. (1997). *Production, breeding and reproduction of sheep,* Bucharest, RO: Ceres Publishing House.

Taftă, V. (2008). *Raising sheep and goats.* Bucharest, RO: Ceres Publishing House.

Timariu, S., Mochnacs, M., Ciolcă, N., Păunescu, J., & Zarcada, D. (1961). Research on the advantages and economic efficiency of early births in raising fine wool sheep. *I.C.Z. Scientific Papers*, XIX, Agrosilvica Publishing House, Bucharest.