ABSTRACT

of the doctoral thesis „Study on the economic efficiency of raising goats for milk production in semi-intensive system", elaborated by PhD Candidate Chetroiu Rodica, scientific coordinator, Prof. PhD Călin Ion, 2016, USAMV – Bucharest

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Carrying out the production activities in the goat farms is the resultant of a system of technical, economic and organizational factors which determine them to maintain at a certain level of performance and economic efficiency. Consequently, the knowledge and permanent analysis of information regarding the development of farm resources in the competitive context in which it operates, are meant to support taking of correct decisions, in order to achieve its objectives.

The integration of farms goats products market in the Community market, in which competitors becoming stronger meet, it requires that the dynamic of the production activities to reach a greater scale and the need for researches and processing technical and economic information to be an essential premise for creating decisional alternatives.

Due to the fact that, until relatively recent period, the goats were studied together with sheep, the economic efficiency issues were handled in common with this species. The trends that currently exist in our country in raising goats, showing a growing interest of farmers for exploitation of this species, are needed to meet with a complex informational support, including the economic issues as an integral part.

In the present study, determining the indicators of the milk production economic efficiency by breed is a novelty in the domain of goats raising in our country and, at the same time, a necessity, given the fact that, until present, the specialty literature has been focused on studying the bio-productive and technological aspects of this species and the results of this study can be used both by education and profile research, and also by production environment.

The researches were conducted within the goats' farm owned by S.C. AGROFAM HOLDING S.R.L., located in Călărași County, on biological material represented by the adult goats and kids of Alba Banat and Carpatina breeds. The first part of the research was aimed at studying the morpho-productive parameters of the two breeds of goats; for this, the research has been focused on the fur color and exterior particularities, morphological particularities, evaluating the body development, being performed body measurements that were the basis for determining the body indices. In addition, the udder measurements were made of the two breeds

that have provided clues on its shape and dimensions, as well as on the suitability to mechanic milking, these constitute another aspect of novelty in the research conducted in the domain of goats in our country.

Also, it was performed the analysis of operating technology in the goat farm of S.C. HOLDING AGROFAM FETEȘTI, studying the aspects regarding housing and maintenance of goats, feeding, care and gather productions, as well as goat breeding and raising kids. Analyzing the particularities of breeding targeted issues related to sexual maturity and age of introduction to breeding, reproduction indices and the measures for its intensification.

The research has continued with studying the economic efficiency at the milk production of Alba de Banat and Carpatina over a period of 3 years (2012, 2013, 2014), starting from the quantitative milk production, features of lactations, drawing the technological estimate and budget of revenues and expenditures, for the purpose of calculation and analysis of technical-economic indicators of the economic efficiency. Finalizing of the research was done by drafting a highly topical business plan for the installing of a young farmer as a manager of a goat farm under the Sub-measure 6.1 of the National Rural Development Program 2014-2020.

For determining the goats body development, it was used the somatic-metric method, by which animal body measurements were made, their position being standing placed forced. The measurements were performed at females in lactations 1, 2 and 3 and at males of ages 1, 2 and 3 years, with zoo-meter, ribbon and compass Wilkens. There have been performed 10 kinds of body measurements: size (height at withers), croup height, trunk length, chest width, perimeter of the chest, chest depth, croup length, croup width of the ischia, the ilium croup width and perimeter of whistle.

In order to assess the proportionality and harmony of different regions or parts of the animal organism, as well as to assess the productive aptitudes, based on body measurements made, there were calculated the following body indexes: index of side body format, index of transverse body format, skeleton index and massiveness index.

Assessing the fur color and exterior features of animals (presence or absence, shape or size of the horns and ears, shape of the udder, its degree of development, the presence of formations named earrings, or goatee) were done by the method of free assessing, bringing animals in natural light.

For determining the kids body weights at birth, at 28 days, at weaning and at 6 months, it was used a weighting scale of platform type with LCD display, being carried out 2 weightings in 2 consecutive days, the value taken into consideration being the average of the two weightings.

There were performed 7 kinds of udder measurements, by different lactations, separately for the two breeds, by using the ribbon, as follows: large perimeter of the udder, small perimeter

of the udder, prior depth of the udder, back depth of the udder, length of the udder, length of the nipples and nipples thickness.

The reproduction indexes used to characterize the reproductive function are those consecrated by the specialty literature: fecundity index, fertility index, prolificacy index and natality index.

The evolution of milk quantity was monitored for a period of three years, 2012-2014, on 4 successive lactations, separately for the 2 breeds under study: Alba de Banat and Carpatina. To determine the quantitative milk production, it was considered *the kids suckling period and the goats milking period*. The assessing of *the milk sucked by kids* was done for 2 successive periods, namely: the suckling period from birth to the age of 28 days (the specific consumption is 5.5 kg milk sucked for 1 kg weight gain), followed by the second period - from age 28 days to 45 days, when the kids weaning occurs (the specific consumption is 4.5 kg milk sucked for 1 kg weight gain). By summation of the quantities of milk sucked into the 2 periods, has resulted *the amount of milk during suckling period*.

Determining *the milked quantity of milk* was done by the official control of the milk production, applying the standard method A_4 for all lactating goats, by different lactations, being carried out 6 official controls from April to September. The calculation of the period of lactation and of milk production by lactations, was performed by using the method Fleichmann (Pascal, 2007).

The primary data obtained were processed statistically using statistical functions available in Microsoft Excel 2007 and the main statistical parameters were determined: arithmetic average, variance, standard deviation, error of average, variability coefficient.

Testing the statistical significance of the differences between averages was performed by using of ANOVA Single Factor, within Excel 2007.

To determine the economic efficiency of goat milk production, based on production technologies described and on allocations of factors resulted from the technical-economic documents and accounting records of the farm, included in the technological estimate, there have been drafted the budgets of revenues and expenditures, on total farm and separate, by breeds, during the 3 years studied: 2012, 2013, 2014.

These were the basis for calculation of the technical-economic indicators system of the goat milk, as well as its economic efficiency analysis, using the consecrated relations from the economics literature.

From the research conducted, the followings have resulted:

- In the farm under study, the semi-intensive growing and exploitation system is practiced,

the animals being maintained in 4 shelters that were originally built for cattle breeding and were later adapted for raising goats. During a year, in the period from November to April, the goats housing takes place in stalling (about 185 days), in the period from May to July (90 days), the animals are grazed on the green cultivated pastures, and during August-October (90 days) the remains of crops from neighboring farms are used for feeding.

- During the stalling period, which begins in November and ends in April, the goats are fed with fodder produced in the own farm, like alfalfa hay, rough fodder (wheat, barley and oats straw), silage, sharps, concentrated fodder (wheat, barley, maize), briquettes and PVM supplements. In the farm has been achieved an investment through that was acquired an equipment for briquettes, which provides a concentrated forage, rich in nutrients and containing 90% alfalfa hay and 10% cereal cracks. During grazing period, goats feeding is made with a mixture of legumes from the pasture cultivated, or alfalfa mowed is administered, plus mixture of concentrated forage.
- The farm is equipped with mechanical milking facility, located in a milking hall of 120 seats, which, however, during these researches was not functional due to its damaging.
- The fur color of Alba Banat goats in the farm under study is uniform white at 87.7% of the animals, the rest presenting certain peculiarities of color, such as white with red and white with brown, aroused due to crossing with genitors from other breeds. At Carpatina goats, the predominant colors are brown and black (29.9% and 20.9%), but there are goats that have the following colors and features: black with white, reddish, gray, gray with black, gray with brown, brown with black.
- The assessment of body development has demonstrated that Alba de Banat goats have larger dimensions than Carpatina goats. Thus, at Alba Banat goats, the upper body line describes an upward trend from anterior train to hindquarters, the waistline has medium size (67.47 cm for females and 72.28 cm for males) and hindquarters more developed than the anterior (at females, the rump height is 68.50 cm and 73.28 cm at males). The results of Carpatina goats body measurements indicate that the waistline is also medium size (67.03 cm at females and 71.83 cm at males) and the hindquarters more developed than the anterior (at females, the height of the rump is 68.03 cm and 72.17 cm at males).
- The udder measurements have indicated that, at both breeds, the udder is subject of changes during lactations; thus, regarding the large perimeter and the small perimeter of the udder, the largest size is reached at lactation 3, then begin to reduce.
- At Alba de Banat, the udder anterior depth increases continuously until lactation 4th (by 33.3%) and in terms of udder rear depth, it has continue dimensional evolution until lactation 3, after that it begins to decline. The udder length reaches the maximum size at the 4th lactation

(30.20 cm), 57.3% higher than in the first lactation. The nipples have the same transformation curve, in the sense that, both their length and width is amplified by the lactation 3, and then begin to fall dimensional.

- At Carpatina breed, at L3, the large perimeter of udder increases by 26.6% compared to L1 and the small perimeter of udder increases by 45.1% between L1 and L3. Also, the udder anterior depth is amplified greatly by 171% over the same interval and the udder rear depth increases by 78.3% at the end of lactations, compared to L1. The udder length has another impressive evolution, being 80.6% higher at L4 compared to L1 and exceeding the Alba de Banat goats, where the growth is 57.3%.
- The udder dimensions averages at Carpatina show that the small perimeter of the udder is slightly larger than the large perimeter and the udder length is 5.4 cm greater than Alba de Banat. Also, the udder depths are larger at Carpatina than Alba de Banat, all these things indicating a different shape compared to Alba de Banat, where the udder is globular, at Carpatina being pear-shaped, more flaccid and not as well hanged of abdomen as the other breed.
- At Alba Banat, the large perimeter of udder is 17.6% larger than Carpatina and the small perimeter of udder is larger by 9.5%. The udder anterior depth at Carpatina is larger by 52.6% compared to Alba of Banat, while the rear depth is higher by 7.5%. Also, the udder length is 20.3% higher at Carpatina compared toAlba de Banat, suggesting a more elongated shape, but nipples at Alba de Banat are longer (by 9%) and thicker (22.7 %) than Carpatina, so are better suited to mechanical milking.
- In terms of weight gain at kids, this is superior at Alba de Banat compared to Carpatina; also, the males record a greater weight gain than the females in both breeds, and the kids resulting from simple births have higher weight gains than those from twin births.
- The average weight of Banat Alba kids is superior to Carpatina kids, at all weightings, as follows: the average weight at birth is higher by 9.26%, the weight at 28 days by 6.2%, the weight at weaning by 5.1% and the weight at 6 months by 4.6%.
- At Alba de Banat, the average weight of kids at birth is 2.961 ± 0.117 kg, compared to Carpatina, which is 2.710 ± 0.099 kg; the kids weight at weaning at the first breed is 8.889 ± 0.174 kg, while at the second breed is 8.460 ± 0.096 kg and the weight at six months is 24.128 ± 0.268 kg, compared with 23.070 ± 0.211 kg.
- By gender, the weight of males is higher than females at both breeds. Thus, at Alba de Banat, the males' weight is 13.8% more than females at birth, 9.8% more at 28 days, 8.2% more at weaning and 6.1% more at the age of 6 months. At Carpatina breed, the males weigh 6.2% more than the females at birth, 6.2% more at 28 days, 7.1% more at weaning and 3.9% more at 6 months of age.

- Average daily gain at kids of Alba de Banat is superior to that of Carpatina kids in all periods of growing, as follows: from birth to 28 days by 4.9% (0.128 ± 0.003 kg compared to 0.122 ± 0.002 kg), from 28 days to weaning by 3% (0.138± 0.003 kg compared to 0.134 ± 0.003 kg), from weaning to 6 months by 4.8% (0.110 ± 0.001 kg compared to 0.105 ± 0.001 kg) and from birth to 6 months by 4.5% (0.116 ± 0.001 kg compared to 0.111 ± 0.001 kg). Also, the largest weight gain is recorded during 28 days - weaning, and the smallest weight gain from weaning at 6 months.
- The fecundity index at Carpatina breed (94.14%) is slightly lower than Alba de Banat (96.24%) by 2.1 percentage points; also, the fertility index is higher at Alba Banat (94.29%) compared to Carpatina (91.74%) by 2.55 percentage points. The prolificacy index value is superior to Alba de Banat (171.58%) compared to Carpatina (140.33%). The birth rate index has also a superior value to Alba de Banat (157.32%) compared to Carpatina (126.30%).
- At both breeds, the largest milk productions were achieved in the 3rd lactation each year under study, with an upward trend from the first lactation. After the 3rd lactation, the milk production decreases, this value being close to the first lactation. Also, at all lactations, the largest quantities of milk were produced in the period from June to July.
- The average milk production at Alba de Banat was 402.86 ± 31.09 kg in 2012, 386.88 ± 29.13 kg in 2013 and 372.37 ± 22.05 kg in 2014.
- The average duration of lactation at Alba de Banat was 257.50 ± 4.11 days in 2012, 256.75 ± 2.84 days in 2013 and 248.25 ± 2.10 days in 2014.
- The average milk production at Carpatina was 275.83 ± 17.08 kg in 2012, 267.18 ± 12.02 kg in 2013 and 264.21 ± 9.39 kg in 2014.
- The average duration of lactation at Carpatina was 227.25 ± 1.03 days in 2012, 223.50 ± 1.48 days in 2013 and 227.75 ± 1.38 days in 2014.
- The average milk production per farm was 339.35 ± 63.70 kg in 2012, 327.03 ± 60.03 kg in 2013 and 318.29 ± 54.24 kg in 2014.
- The average duration of lactation on farm was 242.38 ± 15.17 days in 2012, 240.13 ± 16.67 days in 2013 and 238.00 ± 10.28 days in 2014.
- The lactation curves show that, at both breeds, the largest average daily milk productions were obtained in June-July.
- At the farm level, the highest share in total expenditures structure is represented by the variable expenses (74.21 to 76.28%). Of the total expenditures on farm, the cost of forage represents 68.1% in 2012, 65.4% in 2013, and 65.5% respectively in 2014. In the variable costs, the energy and fuel costs is 1.9-2.2%, the expenditures with medicines and veterinary materials occupy 5.5 to 6.3%, the share of supply 1.8% and 1.6% other material expenses.

- Within total expenses, the fixed costs represent between 23.7-25.8%, being composed of labor costs, general costs and depreciation.
- The milk production of the farm was delivered in two directions: about 85% of the milk was sold to a company for processing milk, at the price of 1.7 lei / kg in 2012, 1.85 lei / kg in 2013 and 1.9 lei / kg in 2014, and the remaining 15% of the amount was delivered to the dairy plant within the holding, at the price of 1.0 lei / kg in 2012 and 1.1 lei / kg in 2013 and 2014. Consequently, the average price calculated for milk delivered was 1.60 lei / kg in 2012, 1.74 lei / kg in 2013 and 1.78 lei / kg in 2014.
- At Alba de Banat goats, the biggest expenses on head are those with feeding, varying depending on the milk production and on the forages prices evolution, being 422.06 lei / year in 2012, 417 34 lei / year in 2013 and 408.65 lei / year in 2014, followed by labor costs, of 126.04 to 144.0 lei / year; in descending order, are the costs with medicines (21.97 to 25.37 lei / year), general costs (8.98 to 9.16 lei / year), energy and fuel (7.64 to 8.70 lei / year), the share of supply (from 8.17 to 8.44 lei / year) and other material expenses (6.38 to 6.51 lei / year).
- For Carpatina goats, there is the same distribution of expenditures by categories, both at breed and head level, like at Alba de Banat goats, the highest share in the structure of total expenses being represented also by variable expenses (71.8 to 75.5%), the rest being fixed expenses.
- The main production value (milk) is higher at Alba de Banat with 45.5 to 51.0% compared to Carpathian breed. In evolution, the main production value at farm level has an upward trend, increasing by 6%, respectively from 495.15 lei / head in 2012 to 524.94 lei / head in 2014, the main factor being the increasing of the delivery price of milk from one year to another, which manages to compensate the production decreasing.
- At farm level, the costs per kg milk increased in 2014 compared to 2012 by 8.4%, from 1.55 lei / kg to 1.68 lei / kg. On breeds, the largest expenditures were done for Carpatina, with 6.6 to 9.3% more than for Alba de Banat.
- The expenses for the main production (milk) expressed per unit of output (unitary cost), were on average per farm of 1.21 lei / kg milk in 2012 and 1.39 lei / kg milk 2014 (+ 14.9%). At Alba de Banat goats, they were 4% lower than at Carpatina in 2012 and 5.6% lower in 2014.
- The indicator variable expenses has the highest value at Carpatina, 5.2% higher than at Alba de Banat in 2012 and 3.3% higher in 2014. During this period, the average of variable costs per farm increased from 1.18 lei / kg milk to 1.24 lei / kg milk (+ 5.1%).
- The fixed expenses per kg milk are 10.3% lower in 2012 at Alba de Banat compared to Carpatina and 22% lower in 2014, the average per farm being 0.37 lei / kg in 2012 and 0.43 lei / kg in 2014.

- The labor expenses were 0.33 lei / kg milk at the farm level in 2012 and rose to 0.39 lei / kg in 2014. Between breeds, the difference was 11.4% in the favor of Alba de Banat in 2012, but increased in 2014, reaching at 20% difference.
- The labor productivity in physical expression (man-hours / kg milk) is the lowest at Carpatina, 16.7% lower than Alba Banat in 2012 and 28.6% lower in 2014. In terms of value, the highest labor productivity is achieved at Alba de Banat, 20.7% higher than Carpatina in 2012 and 32.7% higher in 2014.
- The net rate of return without subsidies (net profit rate) per kg milk is the highest at Alba de Banat, at which was 20.24% in 2012, but fell to 17.27% in 2014. At Carpatina, this indicator ranged between 12.72% in 2012 and 8.43% in 2014. The farm average followed the same downward trend, from 17.15% in 2012 to 13.98% in 2014.
- The net rate of return with subsidies in 2014 was 23.63% at Alba de Banat, and at Carpatina of 16.87%. The farm average was located on a downward trend (from 25.49% in 2012 to 21.11% in 2014) due mainly to the decrease in average milk yields at the two breeds.
- The gross profit per unit of output has the highest value at Alba de Banat, being 0.41 lei / kg milk in 2012, 0.44 lei / kg in 2013 and 0.42 lei / kg milk in 2014, while at Carpatina is 0.36 lei / kg milk in 2012, 0.38 lei / kg in 2013 and 0.34 lei / kg milk in 2014. During this period, the farm average was 0.39 lei / kg in 2012 and 2014 and 0.41 lei / kg in 2013.
- The net profit with subsidies shows the net result of production activity, after expenditures, revenue collection and payment of taxes. It is maintained at the value of 0.31 lei / kg milk within the first 2 years of the period studied, but decreases to 0.29 lei / kg milk at the end of the interval. Between breeds, the highest values are found at Alba de Banat, with 17.9 to 33.3% higher than Carpatina.
- Breakeven point (critical point, were income equals expenditures) in terms of value at the farm level, evolved negatively, its value increasing from 365.03 to 403.78 lei, meaning that over these values, the farm starts to obtain profit. Breakeven in physical units at farm level is 228.86 kg in 2012, drops to 222.29 kg in 2013 and in 2014 increases again to 226.84 kg.
- The operational risk ratio shows that Carpatina has the highest risk (85.34% in 2012, respectively 93.85% in 2014) compared to Alba de Banat, which has the lowest risk (66.76% in 2012, 68.15% respectively in 2014). At the farm level, the operating risk increases from 73.72% in 2012 to 76.92% in 2014.
- The security index at farm level decreased from 0.26 in 2012 to 0.23 in 2014. Alba de Banat has the highest index of security (0.33 in 2012, 0.32 in 2014 respectively), at Carpatina being 0.15 in 2012 and 0.06 in 2014.

- Nevertheless, the farm situation, in terms of economic, is *comfortable*, since the revenues (for example, in 2014, 619.21 lei / head) exceed the breakeven point (403.78 lei / head) by over 20% (by 53.4%). Also, at both Alba de Banat and Carpatina level, the situation is *comfortable*.