

STUDY OF REPRODUCTION INDICES IN COW POPULATIONS BELONGING TO THE TWO SPECIALIZED MILK BREEDS: HOLSTEIN AND SPOTTED WITH ROMANIAN BLACK FROM AGRO-ZOOTECHNICAL FARMS IN NEAMŢ COUNTY

Mariana NISTOR-ANTON, Vasile MACIUC

“Ion Ionescu de la Brad” University of Agricultural Sciences and Veterinary Medicine of Iaşi,
3 Mihail Sadoveanu Alley, Iaşi 700490, Romania

Corresponding author email: marianaanton700@gmail.com

Abstract

This paper presents the results obtained with reference to: average age at first calving (AFC), calving interval (CI), service period (SP) and mammary repose (RM). They were studied 3 farms with populations of cows of the breeds: Holstein and Spotted with Romanian Black (BNR). The studied reproduction indicators recorded the following average values: in the farm “Î.I. Dascălu Sinziana”, in the Holstein breed, AFC - was 31.03 months, SP - 89.24 days, RM - 55.82 days and CI - 458.27 days, in the farm “Nacu Gheorghe” in the Holstein breed, AFC- was 25.72 months, SP - 87.96 days, RM - 57.58 days and CI - 459.51 days, and in the Spotted Romanian Black breed, AFC - was 27.54 months, SP - 97.22 days, RM - 56.92 days and CI - 401.64 days. The best results regarding the breeding activity were obtained in the farm “Î.I. Rătan Gheorghe”, in Spotted with Romanian Black cattle, where AFC - was 27.52 months, SP - 80.04 days, RM -59.43 days, and CI - 393 days. From the analysis of the obtained data, it is revealed the need to reduce the service period, in the farms “Î.I Dascălu Sinziana” and “Nacu Gheorghe”, at the optimal level of 80 days, because it is the only way to improve the reproduction indices.

Key words: cows, Neamt, reproduction indicators, reproduction management.

INTRODUCTION

In the world economy, cattle breeding accounts for over 96% of the total milk production. The average annual global consumption of milk is: 98.37 kg/inhabitant, of which 96.31 kg are cattle milk. It is therefore necessary to genetically improve and develop technologies, especially in cattle breeding, which can lead to an increase in milk production to a level where it can meet, in many countries of the world, a large part of human food requirements (Coman et al., 2019). The numerical increase of cattle herds and the continuous improvement of its productive potential, expressed mainly by the increase of milk and meat production, must be a permanent concern for cattle breeders. Along with the other farm factors (differentiated feed on productive levels, milking of lactating cows, hygiene conditions, appropriate microclimate), the reproductive function is specific and dominant (Maciuc, 2012). The gradual return to the traditional growth system, with small and medium farms, a conclusive expression of the privatization process of agriculture, at the same

time with the introduction and expansion of appropriate growth and exploitation technologies, must ensure in our country the increase of reproduction indicators (Otiman, 1995). The reproduction process can be conducted and monitored on a farm by estimating the values of reproduction indices. Depending on their level, we can intervene to remove deficiencies during the technological flow (Acatincăi, 2004). Cattle have some reproductive features, namely: they are introduced later for breeding, the first calving takes place between 25-27 months, they produce only one calf per year, the twin calvings represent only 2-4% and the reproductive life is not too long, requiring a high replacement rate (15-25%) (Georgescu et al., 1998).

MATERIALS AND METHODS

In order to make an analysis of the reproductive performances, three farms were studied, with populations of cows specialized for milk production, from the Holstein and Spotted with Romanian Black (BNR) breed, during

01.10.2017 - 30.09.2020, registered in the COP (Official Control of Production). In the agro-zootechnical farm "Î.I. Dascălu Sînzîiana", the performances regarding the breeding function in cattle, from the Holstein breed (29 heads) were analyzed. In the "Nacu Gheorghe" farm, the breeding indicators were estimated for Holstein cattle (29 heads) and Spotted with Romanian Black (25 heads). In the farm "Î.I. Râtan Gheorghe", the reproductive performances were analyzed for BNR cattle (32 heads). A series of indicators were studied such as: age at first calving (AFC), period of service (SP), mammary repose (RM) and calving interval (CI). The primary data were extracted from the records of the holdings, but also from the records of the accredited Associations for performing the control of their own individual performances in the cattle species. They have been systematized, statistically processed and interpreted by methods specific to such research. The statistics, respectively the parameters, which characterize a normal distribution, are on the one hand the average or median, and on the other hand, the dispersion indices, represented by variance, standard deviation, variability coefficient (V%) of the followed character. Statistics are noted in Latin letters: arithmetic mean (X), variance (s^2), standard deviation (s), coefficient of variability (V%), and parameters in Greek letters: theoretical mean (media), variance (σ^2) and deviation standard (σ). It should be mentioned that the data analysis was performed in terms of merging and correlating with the numerous observations made directly on farms and with the reporting of the results obtained to the requirements and rules of the European Union (EU).

RESULTS AND DISCUSSIONS

Tables 1 and 2. shows the average and variability of reproduction indices in the populations of cows of the breeds BNR and Holstein. The analysis of the main reproduction indicators showed the following:

- Age of first calving (AFC). This indicator is closely related to the precocity of the breed and is calculated from the zootechnical records, which record the date of birth and the date of first calving. Both breeds are

early breeds, so in the Holstein breed the first calving is done at 25 months, and in the Spotted with Romanian Black breed at the age of 27 months (Alexoiu & Roşca, 1988). In the Holstein breed, AFC - had an average value ($X = 25.72$ months with limits between 20-38 months), in the farm "Nacu Gheorghe", a higher value, respectively ($X = 31.03$ months with variability between 24-39 months) was registered in the farm "Î.I. Dascălu Sînzîiana", which indicates that in this farm, the calves in heat were not detected and sown at the optimal time. The average age at the first calving was close to the data from the specialized literature, in the Spotted with Romanian Black and breed, for the 2 farms ($X = 27.54$ with variability between 24-39 months) in the "Nacu Gheorghe" farm and, respectively ($X = 27.52$, with variability between 22- 40 months) in the farm "Î.I. Râtan Gheorghe".

- Service-period (SP). For cows that have calved before, it represents the interval (in days) from parturition to fertilization. Individually, after each parturition, the service-period is calculated, using the formula, $SP = Z_g - Z_f$ in which Z_g = the day of fertile sowing, Z_f = the day of the last calving. The optimal duration of gestational rest in cows is 80 days, when it ensures a lactation of 305 days (Baul, 2009). This indicator had normal average values for the BNR breed from the farm "Î.I. Râtan Gheorghe" ($X = 80.04$ with variables between 28-228 and higher values $X = 97.22$, with variables between 19 and 441 days) in the farm "Nacu Gheorghe" also in the Romanian Black and White breed. For the Holstein breed, this indicator had approximately equal values in the 2 farms, but higher than the optimal value ($X = 89.24$, with variables between 26 and 228 days) in the farm "Î.I. Dascălu Sînzîiana" and, respectively ($X = 87.96$, with variables between 24 and 244 days) in the farm "Nacu Gheorghe". The gestation was performed in the first 3-4 cycles, but the individual variability for this index was extreme, the gestation was performed after 228, 244 days and in some cases even after 441 days.
- Mammary repose (RM). The duration of breast rest is, on average, 60 days, being in a

positive correlation with the productive level (Georgescu et al., 1998). This indicator was within normal limits, in terms of average value, of the Holstein breed ($X = 55.82$, with variables between 10 and 145 days) on the farm „Î.I. If Sînzîiana and, respectively ($X = 57.58$ with variables between 20 and 125 days) in the farm “Nacu Gheorghe”. The average value of this indicator was also in the case of the Spotted with Romanian Black breed, within normal limits ($X = 56.92$ with variables between 15 and 135 days) in the “Nacu Gheorghe” farm and, respectively ($X = 59.43$ with limits between 30 and 115 days) on the farm “Î.I. Râtan Gheorghe”. The individual variability for this index was in some cases very high, both in the Holstein breed and in the BNR.

- Calving interval (CI). It can be calculated individually, representing the interval between two successive calvings, for cows that have calved before, and results from the formula $CI = SP + DG$ where: SP = gestational rest, DG = gestational duration (Virginia et al., 2003). It is estimated that the interval between calvings is good if its duration is between 365-395 days

(Cassandro & Marusi, 2000). The interval between calves is a synthetic index, which best highlights the reproductive activity of a farm (Gîlcă & Doliş, 2006). The average value of this reproduction index, in the Holstein breed populations of the two farms, was well above the normal limits ($X = 458.27$ with variables between 405 and 516 days) in the farm “Î.I. Dascălu Sînzîiana” and, respectively ($X = 459.51$ with variables between 392 and 516 days) in the “Nacu Gheorghe” farm. Slightly better results regarding this indicator were obtained for the BNR breed, in the “Nacu Gheorghe” holding having the value ($X = 401.64$, with variables between 325 and 483 days and, respectively ($X = 393$, with variables between 329 and 474 days) in the farm “Î.I. Râtan Gheorghe”. In farms that raise and farm Holstein cows, the calving interval exceeded the average value of 400 days, which proves that the management of the breeding function was not a basic concern (Figure 1.). Dispersion indices also highlight some particular situations with a calving at an interval of 516 days in the Holstein breed, in both farms.

Table 1. The average and variability of reproduction indexes at Holstein breed cow population registered in the COP (official production register) for 2017-2020

Specification	Samples statistics	AFC (months)	SP (days)	RM (days)	CI (days)
Î.I. Dascălu Sînzîiana - Holstein breed	n	29	29	29	29
	X	31.03	89.24	55.82	458.27
	s	4.57	56.16	30.28	23.98
	s ²	20.96	3154.90	917.29	575.33
	v%	14.72	62.93	54.24	5.23
	Min	24	26	10	405
Nacu Gheorghe - Holstein breed	Max	39	228	145	516
	n	29	29	29	29
	X	25.72	87.96	57.58	459.51
	s	3.68	59.49	26.09	26.57
	s ²	13.56	3539.46	680.75	706.49
	v%	14.30	67.63	45.31	5.78
Nacu Gheorghe - Spotted With Romanian Black breed	Min	20	24	20	392
	Max	38	244	125	516

Table 2. The average and variability of reproduction indexes at Spotted with Romanian Black breed cow population

Specification	Samples statistics	AFC (months)	SP (days)	RM (days)	CI (days)
Nacu Gheorghe Spotted With Romanian Black breed	n	25	25	25	25
	X	27.54	97.22	56.92	401.64
	s	4.8	89.10	26.87	32.95
	s ²	23.11	7940	722.32	1086.24
	v%	17.42	91.58	47.20	8.20
	Min	24	19	15	325
Max	39	441	135	483	

Specification	Samples statistics	AFC (months)	SP (days)	RM (days)	CI (days)
Î.I. Râtan Gheorghe Spotted With Romanian Black breed	n	32	32	32	32
	X	27.52	80.04	59.43	393
	s	4.74	44.60	22.26	37.48
	s ²	22.51	1989.87	495.93	1404.92
	v%	17.22	55.72	37.45	9.53
	Min	22	28	30	329
Max	40	228	115	474	

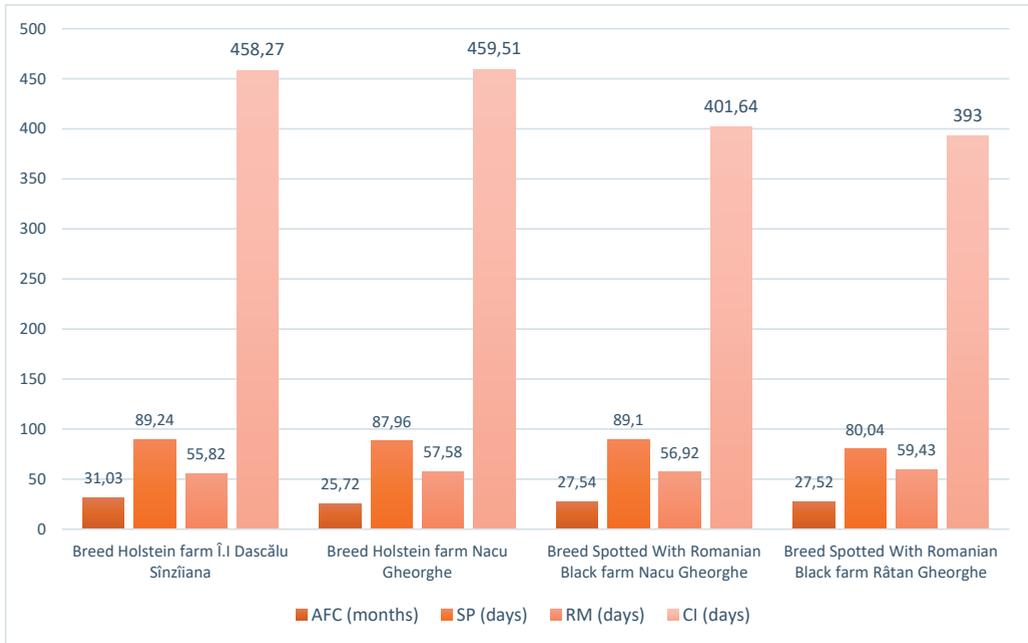


Figure 1. The average of reproduction indexes at Spotted with Romanian Black and Holstein cow population registered in the COP (Official Production Register) for 2017-2020

CONCLUSIONS

From the analysis of the systematized data, statistically processed and interpreted in this study, the following conclusions can be drawn:

1. Age of first calving (AFC). This index had average values close to those indicated in the literature for the 2 breeds analyzed in this study, except for the exploitation of "Î.I. Dascălu Sinziiana", where this indicator exceeded 30 months, recording the average number of 31.03 months with variables between 24 and 39 months. The age at which cattle should be introduced for breeding has a special importance (correlated with a normal weight and body development) on the economic future of the herd. It should be noted that in cattle, the young are suitable for breeding or artificial insemination, when they reach 70% of adult weight. Late introduction to

reproduction can lead to the occurrence of fatty degeneration of the ovaries, and repeated heat causes ovarian cysts, which affect the reproductive function of the calf, reduced calf count and milk production per life time, higher costs per animal and per unit of product. At the same time, it is possible to observe the premature age of introduction of calves for reproduction, in the "Nacu Gheorghe" farm, at only 10.5 months. Animals do not sow artificially immediately after the onset of sexual maturity, but only at the optimal age for reproduction (in the case of the Holstein breed the optimal age is 15-16 months). Sowing too early can lead to, interruption of the growth process, animals remain at a stage of incomplete body development, below the standard weight of the breed, after calving give totally inadequate milk production, well below

the potential of the breed, the products obtained are also, poorly developed.

2. Service-period (SP). This indicator had the normal average value, for the BNR breed from the farm "Î.I. Râtan Gheorghe" ($X = 80.04$ with variables between 28-228 and higher values and, respectively ($X = 97.29$, with variables between 19 and 441 days) in the farm "Nacu Gheorghe", also in the BNR breed. It should be noted in this case as well the great variability between the individuals of the population, the maximum amplitude having high values, of 228 days in the farm "Î.I. Râtan Gheorghe" and, very high of 441 days in the farm "Nacu Gheorghe". We also notice that cows were sown in the first heat cycle, but in cows that have more than one calving, the sowing is done in the third heat cycle, especially in high production cows. In the second heat cycle, cows with lower milk production are sown, and under 60 days they are not sown. This reproductive parameter is of particular importance because it influences both the reproductive capacity and the age structure of the cattle herd on the farm, milk production and farm efficiency, so it is necessary to track and detect cows in heat with great responsibility in dairy cows.

3. Mammary repose (RM). This indicator was within normal limits, in terms of average value, both in the Holstein breed and in the Spotted with Romanian Black Breed. Note, however, the individual variability for this index, the minimum value being 10 days in the farm "Î.I. Dascălu Sînziiana", for the Holstein breed, for 15 days for the BNR breed in the "Nacu Gheorghe" farm and, respectively, for 20 days for the Holstein breed in the "Nacu Gheorghe" farm. Breast rest cannot be reduced below 30 days, regardless of the productive level and even if the cows are in a very good state of maintenance, as the milk production decreases in the next lactation.

4. Calving interval (CI). It is a breeding indicator that can only be calculated in cows that have calved at least twice. Satisfactory results regarding the average value of this indicator were obtained in the BNR breed, in the holding "Î.I. Râtan Gheorghe" having the

value ($X = 393$, with variables between 329 and 474 days) and, respectively in the farm "Nacu Gheorghe" ($X = 401.64$, with variables between 325 and 483 days), also for the BNR breed. It is also revealed in the case of this indicator, which defines the reproductive activity, the accentuated individual variability, registering high values, well above the optimal value, which is up to 400 days. Calving interval is a weak heritable character, the value of heritability being 0.1, therefore obtaining superior results in improving the management of cattle breeding activity, from the farms studied, will be possible if a series of measures are taken, such as: improving the breeding and exploitation environment of cattle, optimizing the structure of the herd, directing the breeding activity (retention and judicious scheduling of all calves, elaboration of the mating plan, daily detection of females in heat, insemination at the age and optimal moment of the females, monitoring their "return"), establishing the diagnosis of pregnancy, following the involution of the uterus after calving, 7-14 days, practicing the monthly gynecological examination in cows and calves with reproductive disorders, correct and timely recording of all reproductive events. In the cow farms studied, the system of staggered inseminations and calvings is practiced, this involves planning for insemination and, therefore, for calving 20-30% of cows in each quarter of the year, thus ensuring the maintenance of the optimal structure of the herd by physiological conditions respectively throughout the year: 80% of the cows should be lactating and 20% at breast rest. The decrease in the percentage of cows in lactation indicates deficiencies in reproductive activity.

ACKNOWLEDGEMENTS

This study was conducted with the support of the Associations of Cattle Breeders: "Operator I.A." Neamț and the Association from Mureș County, the National Agency for Animal Husbandry, as well as the owners of dairy cattle: Dascălu Sînziiana, Râtan Gheorghe and Nacu Gheorghe.

REFERENCES

- Acatincăi, S. (2004). *Productions in bovines. Second Edition*. Timisoara, RO: Eurobit Publishing House.
- Alexoiu, A., & Roșca, L. (1988). *Practical guide for selection and management of mates in cattle farms*. București, RO: Ceres Publishing House.
- Angelov, M.K., & Gaidarska, B.M. (1985). Evaluation of the realized genetic gain of the black and with population. *Animal Science, XXII (11)*,13-16.
- Arișanu, I. (2000). To raise and exploit cows with high milk production. *Farmer's Magazine, I (1)*, 36. Bucharest, RO: Agras Publishing House.
- Baul, S. (2009). *Research on the main factors that influence the quantity and quality of milk in the Romanian black and white breed. Thesis*. USAMVB Timisoara.
- Cassandro, M., & Marusi, M. (2000). Technical economic analysis in dairy farms. *Black and White, I (10)*, 30.
- Coman, I.T., Vidu, L., Marin, M.P., Ștefan, G., & Mărginean, G.E. (2019). Proposals for legislative measures to improve the legal framework on the production and processing of milk, elimination of fake products from the milk market and growth of consumer trust. The milk law project. *Scientific Papers, Series D. Animal Science, 62(1)*, 236-241.
- Georgescu, G., Ujică, V. et al. (1998). *Treaty for cattle breeding, vol. IV*. Bucharest, RO: Ceres Publishing House.
- Gilcă, I., & Doliș, M. (2006). *Animal breeding technologies*. Iasi, RO: ALFA Publishing House.
- Grosu, H., & Pascal, A. (2005). *Genetic improvement programs in zootechnics*. Bucharest, RO: Ceres Publishing House.
- Maciuc, V., (2006). *Cattle Breeding Management*. Iasi, RO: Alfa Publishing House.
- Maciuc, V. (2012). *Cattle Breeding*. Botosani, RO: Technical Publishing House.
- Maciuc, V., Leonte, C., & Radu-Rusu, R. (2015). *Manual of good practices in cattle breeding*. Iasi, RO: Alfa Publishing House.
- Onaciu, G., & Velea, C. (2000). *Appreciation and control productions in cattle*. Cluj-Napoca, RO: Carti de stiinta Publishing House.
- Oțiman, I.P. (1995). *Romanian agriculture at the turn of the second and third millennium*. Timisoara, RO: Helicon Publishing House.
- Podar, C., & Oroian, I. (2003). *Raising and exploiting dairy cows in population households*. Targu Mures, RO: Tipomar Publishing House.
- Velea, C., & Mărginean, G. (2004). *Production, reproduction and improving of cattle. Vol. III*. Bucharest, RO: Bucharest Agrotechnical Publishing House.
- Virginia, Z., Maciuc, V., Nacu, Gh., & Zota, D. (2003). *Animal breeding*. Iasi, RO: Alfa Publishing House.