COMPARATIVE STUDY ON EVOLUTION OF REPRODUCTION INDICES IN HOLSTEIN COWS FROM ROMANIA

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Abstract

The objective of this study was to evaluate the evolution of the main reproduction indices registered by the Holstein cows from Romania, in regard with the correlation between their values and the economic efficiency of the exploitation of this category. The data processed for this paper were collected between 2012 and 2017, and the comparison of the results was made with the results obtained in Romania 20 years ago by another author. The indicators evaluated were: the calving interval, defined as the number of days passed between two consecutive calves, the dry period, represented by the period in which the cows aren't milked and the age of the first parturition, expressed in days. The comparison of the data was done based on the following statistics, determined using the Excel software: mean, mean error, standard deviation, and coefficient of variability. The data presented in this paper were collected from 59 farms located throughout Romania and correspond to 40,770 complete lactations. The overall trend of the values recorded by these indices was improving over time.

Key words: age of the first parturition, calving interval, dry period, Holstein livestock, reproduction indices.

INTRODUCTION

The success of any genetic improvement program of the Holstein breed population of dairy cows exploited in Romania is directly dependent on knowing the breeding para-meters. Thus, in order to establish the object-tives of genetic improvement, we must fully understand the state of the Romanian Holstein livestock.

Another valence of knowing these indicators has very important economic implications. Any farmer wants his livestock to show productive and reproductive precocity manifested by reducing the age at first calving, maintaining an optimal value for the calving interval (the ideal value is equal to or less than 365 days) and achieving a correct correlation between the productivity of animals, the system of exploi-tation and the duration of the dry period.

In this context, the present paper, along with other such works, may be one of the premises of a future genetic improvement program that takes into account the complicated relationship between the production conditions in Romania, the possibilities of the Romanian Holstein population and the characteristics of the milk market in the country characterized by the price volatility offered to the producer and the crises with various causes that periodically affect this market.

MATERIALS AND METHODS

For this comparative study, we used the data presented in a paper published in the past by Murat in 1997 that treated the same subject, and the comparison was made with the results obtained from data generated between 2012 and 2017 with the purpose of the Official Control of Production by the HolsteinRo Cow Breeders Association.

To estimate the values of each reproductive indices, we used the mean, average error, standard deviation and coefficient of variability.

The statistical accuracy of the results was provided by a database that involved more than 40,000 records represented by the lactations of a total of over 25,000 cows from the Holstein breed exploited in about 60 farms across Romania. Statistical data processing was done with the Excel program.

RESULTS AND DISCUSSIONS

Age at first calving (A.F.C.) is an important indicator of the precocity of milk production. For the period considered by Jeana Murat and I. Murat in the 1997 paper, it was recorded an average of 965 days for the active population. The trend of this indicator was upward, rising from 833 days in 1971 to 912 days in 1994, which led to a proportional increase in the unproductive period of livestock with a negative impact on economic performance.

For the period under review, the results obtained from the statistical processing are shown in Table 1.

Table 1. Evolution of the A.F.C.

Year	n	$X \pm s_x$	S	V%
2011	680	817.34 ± 6.30	164.28	20.10
2012	1464	817.40 ± 4.96	189.86	23.23
2013	2435	823.57 ± 4.14	204.33	24.81
2014	4677	811.58 ± 2.37	161.83	19.94
2015	6531	796.94 ± 1.88	151.59	19.02
2016	7487	781.81 ± 1.39	120.25	15.38
2017	33	821.91 ± 15.49	88.96	10.82
Mean	**23307**	**799.71 ± 1.01**	**154.88**	**19.37**

The trend recorded by this indicator for the period between 2011 and 2017 is shown in Figure 1. There is a general downward trend.

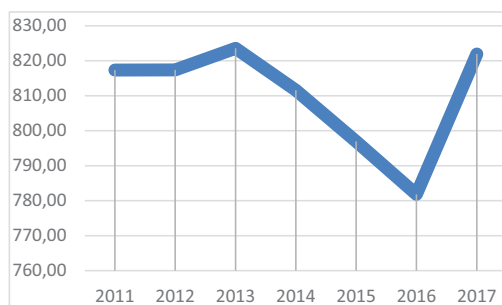
Figure 1. Trend of A.F.C.

The average for A.F.C. for the current period is 799.91 ± 1.01 days with a standard deviation of 154.88 days and a coefficient of variability of 19.37%, indicating a relative homogeneity of the values. The maximum value was recorded in 2013 and was 823.57 ± 4.14 days. Also this year was the highest coefficient of variability

(24.81%). In 2016, the minimum value for A.F.C. was reached. This was 781.81 ± 1.39 days with a standard deviation of 120.25 days and a coefficient of variation of 15.38%.

Calving interval (C.I.) is the indicator that provides information on the rhythm of reproduction in dairy cows and results by summing up the gestation duration and service period (Vidu, 2002).

Jeana Murat and I. Murat determined an average value, for the period between 1971 and 1994, of 438 days, which varied between 393 days in 1971 and 455 days in 1984. They also noted the sinuous character of the curve describing this indicator in the succession of lactations, especially between lactation 6th and 12th (Figure 2).
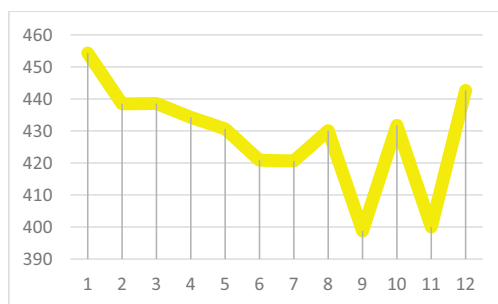

Figure 2. Sinuous character of the curve describing C.I. in the succession of lactations in period from 1971 to 1994

For the period between 2011 and 2017, C.I. had an average of 427.85 ± 1.07 days with a standard deviation of 111.56 days and a coefficient of variation of 26.07% (Table 2).

Table 2. Evolution of the C.I.

Between lactations	n	$X \pm s_x$	S	V%
1 and 2	5039	422.86 ± 1.39	98.40	23.27
2 and 3	3046	431.56 ± 2.15	118.63	27.49
3 and 4	1694	432.63 ± 3.00	123.35	28.51
4 and 5	777	428.50 ± 4.45	124.02	28.94
5 and 6	265	440.38 ± 8.14	132.51	30.09
6 and 7	94	437.26 ± 13.20	127.25	29.10
7 and 8	31	443.23 ± 18.73	104.30	23.53
8 and 9	12	469.50 ± 36.90	127.83	27.23
Total Mean	**10958**	**427.85 ± 1.07**	**111.56**	**26.07**

The variability of this indicator is relatively large, both overall and for each lactation in

part, which can be an advantage in the activity of genetic improvement of the Holstein cow population in Romania.

The lowest value of C.I. was recorded between 1st and 2nd lactation and was 422.86 ± 1.39 days with a standard deviation of 98.40 days and a coefficient of variation of 23.27%. The longest duration of C.I. was performed between lactations 8 and 9 and was 469.50 ± 36.90 days with a standard deviation of 127.83 days and a coefficient of variability of 27.23%.

Compared to the results published in 1997, there is a reduction in the graphic curve sinuosity and a more pronounced tendency to increase the value of C.I. (Figure 3).
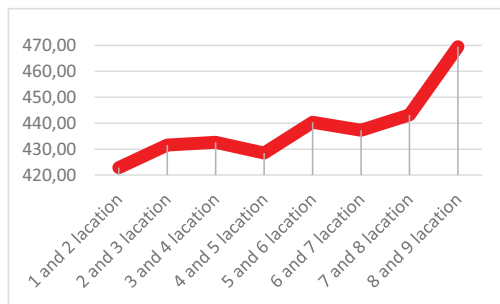

Figure 3. Sinuous character of the curve describing C.I. in the succession of lactations in period from 2011 to 2017

In neither case, the C.I. did not reach the optimum between 365 and 400 days. This situation is due to the duration of service period, which appears to be arrhythmic, character imprinted to the C.I. to. Starting from the premise that gestation duration is about 270 to 280 days for Holstein population in Romania, we can estimate an average service period duration of 147.85 - 151.85 days.

Dry period (D.P.) is the third reproduction indicator described in this paper and can be defined as the period, expressed in days, which flows from the end of a lactation to the next calving (Velea and Mărginean, 2012).

In 1997, Jeana Murat and I. Murat found for D.P. an average value of 95.91 ± 0.27 days with a standard deviation of 31.58 days and a 32.91% variability coefficient. The value of the variability coefficient suggests a reduced homogeneity of this indicator, which, as in the

case of C.I., may be beneficial in the work of genetic improvement of the Holstein population of Romania.

For the current period, the statistic of D.P. is shown in Table 3.

Table 3. Evolution of the D.P.

Between lactations	n	$X \pm s_x$	S	V%
1 and 2	5666	62.30 ± 0.51	38.41	61.66
2 and 3	3574	80.80 ± 1.29	76.93	95.21
3 and 4	3114	81.96 ± 1.40	77.90	95.05
4 and 5	361	81.97 ± 3.91	74.26	90.59
5 and 6	133	90.66 ± 6.97	80.39	88.67
6 and 7	54	83.70 ± 7.98	58.64	70.06
7 and 8	20	89.35 ± 12.17	54.44	60.93
Total Mean	12922	73.13 ± 0.56	63.86	87.33

The mean value of D.P. is 73.13 ± 0.56 days, with a standard deviation of 63.86 days and a very high variability coefficient of 87.33%, which suggests an increased heterogeneity of the data string that determined these values. D.P. lasts the most between the 5th and 6th lactation when it reaches 90.66 ± 6.97 days, with a standard deviation of 80.39 days and a coefficient of variation of 88.67%. The minimum duration is between lactations 1 and 2 and is 62.30 ± 0.51 days, with a standard deviation of 38.41 days and a coefficient of variation of 61.66%.

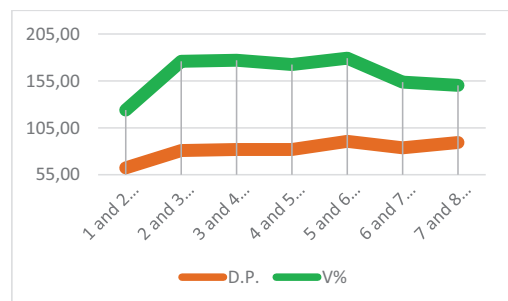Figure 4 shows the curve appearance describing the duration variation of D.P.

Figure 4. Sinuous character of the curve describing D.P. and variability of V% in the succession of lactations in period from 2011 to 2017

The interval in which the value of the coefficient of variability, in the lactation

sequence, varies is between 60.93% (between 7th and 8th lactation) and 95.21% (between 2nd and 3rd lactations).

Figure 4 suggests a positive correlation between the evolution of D.P. and the value of the coefficient of variability.

CONCLUSIONS

Age at first calving decreased from 912 days, as it was in 1994 to 799.71 ± 1.01 days, as it is today. This indicator decreased by 112.29 days during the analyzed period.

The duration between two calves was reduced by 14.79 days from 442.64 ± 1.03, the value published in 1997, to 427.85 ± 1.07, as is currently the case.

The dry period decreased from 95.91 ± 0.26 days, as it was in 1997, to 73.13 ± 0.56 days, as it is now.

In the case of the A.F.C. there was a small value of the coefficient of variability, of only 19.37%, a value explained by the influence of the biological limitations.

For the other two indicators studied (C.I. and D.P.) there was a high and very high variability revealed by coefficients of variability of 26.07% and 87.33%, respectively. It is possible that these values can be explained by the variable and deficient management existing on Romanian farms. This situation creates a favorable ground for the genetic improvement of reproduction of the Holstein population in Romania.

In synthesis, the three indicators studied for this paper have improved over the last 20 years as follows: A.F.C. improved by about 12.31%, C.I. improved by about 3.34%, and D.P. with 23.75%.

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