FERTILITY PARAMETERS AND THEIR HERITABILITY IN A DAIRY CATTLE HERD

Fertilitätsparameter und ihre Erblichkeit in einer Milchühefarm

Paramètres de la fertilité et leur héritabilité dans un élevage de vaches laitières

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Introduction

Fertility in cattle breeding is a problem concerning the herd during all its development and must be carefully controlled in all its aspects.

The parameters utilized for control and study of reproduction are numerous: every one must be related to the times required for cows reproductive function. For this purpose we considered in this research three parameters: age at 3rd calving, mean interval between calvings and mean service number per calving.

The last two parameters show both the course of reproductive function during all the cow's life, and her pregnancy possibility; the first parameter, i. e. the age at third calving may give information about the precocity of the cow and the reproduction course; this information may be got when a judging criterion is still useful for selection. In this research we have tried to analyse the meaning of the three parameters and their practical behaviour inbreeding.

Matherial and methods

The data concerning ten groups of half sibs, for a total of 560 cows, have been got out from the registers of a Holstein Friesian herd. Nine of the 10 sires were of North-American strain, while 1 (i. e. the number 9) was of Dutch strain. Each of the 10 sires have been utilized in a period from 1965 to 1969. On the data available for each cow, the age at third calving, the mean interval between calvings and the mean service number have been calculated. Moreover, we have

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TABLE 1

MEAN STANDARD DEVIATION AND STANDARD ERROR FOR THE THREE CONSIDERED PARAMETERS AND FOR EACH HALF-SIBS GROUPS

Sire	Daughters No.	Interval between calvings			Age at 3rd calving			Mean service number per calving		
		Mean	σ	Standard error	Mean	σ	Standard error	Mean	σ	Standard error
1.	108	1699.12	118.42	11,19	396.19	38.76	3.74	1.86	0.71	0.07
2.	97	1685.24	103.47	10.50	394.31	45.74	4.59	1.73	0.54	0.05
3.	41	1730.26	113.36	17,70	403.87	39.23	6.12	1.69	0.48	0.08
4.	55	1741.65	117.78	15.88	410.58	48.02	6.47	1.87	0.82	0.11
5.	33	1746.27	137,46	23.92	423.88	53.01	9.37	1.87	0.56	0.10
6.	33	1681.39	107.61	18.73	388.58	36.35	6.32	1.81	0.63	0.11
7.	33	1729.36	119.43	20.79	403.59	44.13	7.68	1.93	0.60	0.10
8.	33	1723.00	114.94	20.00	409.07	45.68	7.95	1.88	0.52	0.09
9.	27	1638.00	115.68	22.26	381.62	27.25	5.24	1.74	0.51	0.10
10.	100	1738.85	114.78	11.47	399.31	44.10	4.41	1.88	0.60	0.06
	TOTALE... ... 560	1712.24	155.69	6.61	399.23	45.04	1.90	1.82	0.62	0.02

TABLE 2

VARIANCE ANALYSIS OF THE THEREE CONSIDERED PARAMETERS AND THEIR HERITABILITY EVALUATION

Variability sources	Deviance	Degrees of freedom	Variance	F	Significance	Correlation coeficient	h^2	Standard error
AGE AT 3rd CALVING								
Total	13453200	555						
Intra groups	617104	9	68567.11035	2.91659	**	0.03445	0.1378	0.096231
Into groups	12836096	546	23509,33325					
MEAN INTERVAL BETWEEN CALVINGS								
Total	1064505	558						
Intra groups	44876	9	4986.22217	2.68474	**	0.030254	0.121016	0.088878
Into groups	1019629	549	1857.24771					
MEAN SERVICE NUMBER PER CALVING								
Total	446147,69531	558						
Intra groups	12263,54272	9	1362.61584	1.72414	n. s.	0.013232	0.052929	0.059099
Into groups	433884,15234	549	790.31721					

calculated the means, the standard deviation and the standard error of these parameters, both on the total and on each half sibs group. Furthermore the variance analysis have been performed and, by means of the inter-class correlation coefficient, the heritability of the three parameters have been estimated.

We calculated also the following correlations coefficients and their significance, on the total and on each group:

age at third calving/average interval between calvings;
age at third calving/average service number per calving;
average interval between calvings/average service number per calving.

Results

Tables 1-2-3 shown the results of three performed analysis. Table 1 reports for the 10 groups and for the total number of observations, the mean, the standard deviation and the standard error for the three examined parameters. Table 2

TABLE 3

Correlation coeficients and their significance for the three considered parameters on each half sibs group on the total

	Age at 3rd calving/mean interval between calvings		Age at 3rd calving/mean service number per calving		Mean interval between calvings/mean service number per calving	
Toro	Correlation coefficient	Significance	Correlation coefficient	Significance	Correlation coefficient	Significance
1.	0.210271	*	0.352705	***	0.661681	***
2.	0.521428	***	— 0.038424	n. s.	0.466382	***
3.	0.604333	***	0.367714	*	0.613929	***
4.	0.707339	***	0.666655	***	0.734095	***
5.	0.821631	***	— 0.109347	n. s.	— 0.103930	n. s.
6.	0.577004	***	— 0.151435	n. s.	0.085911	n. s.
7.	0.675805	***	0.575530	***	0.617797	***
8.	0.617725	***	0.418942	*	0,524243	***
9.	0.570674	***	0.237704	n. s.	0.604322	***
10.	0.644916	***	0.441354	***	0.416816	***
Total ...	0.507796	***	— 0.026561	n. s.	0.013227	n. s.

reports the variance analysis, the h^2 and its standard error; in Table 3 the correlation coefficients and their significance both on the total and on each group, are reported.

Conclusions and discussion

Considerations useful in the breeding practice may be drawn out from an examination of the over reported results. The variance analysis, in fact, points out the significant influence of the sire on the age at third calving and on the interval between calvings; in fact these parameters have an h^2 value respectively of 0.14 and 0.12; on the contrary, any influence of the sire on the average service number per calving must be excluded, since the h^2 value is only 0.05.

The calculated correlations point out the higly significant association between age at 3rd calving and average interval between calvings, while the other two correlations were not significant on the total sampling. The correlations between age at third calving and average service number per calving, and between average interval and average service number show different values in the 10 half sibs groups (Table 3).

This indicates the need of accurate analysis of all the available factors and points out how, owing to the numberous factors influencing the association, this could be present only in some of the analysed samples.

The age at third calving can be suggested therefore as an efficient selective criterion, since this parameter can be got when selection is still possible, presents a not insignificant hereditability degree and is futhermore related to a regular calving course.

To better define the validity of this parameter, further investigations will be necessary on the correlation of the age at 3rd calving with the other parameters of the productive and reproductive life of the cow, e. g. the calving number during the life and the production levels.

SUMMARY

The age at the third calving, the mean interval between calvings and the mean service number for calving are utilized for the fertility state control and for selection in a single breeding. By means of 10 half sibs groups the authors calculate the h^2 of the considered parameters, and study their correlations both on the total and within each half-sibs group.

ZUSAMMENFASSUNG

Die Autoren benutzen das Alter bei der dritten Geburt, den mittleren Abstand zwischen den Geburten und die durchschnittlche Zahl der Befruchtungen die für eine Schwangerschaft notwending waren, als Fruchtbarkeistparameter, den man in eines Farm anwenden Sollte, *a*) Zur Kontrolle des Fruchtbarkeit, *b*) Zur Auslese. Bei gleichzeitiges Beobachtung von 10 Halbschwestergrupper werden die Erblichkeitskoeffizienten jener Parameter bestimmt, und ihre Korrelationen sowhl mit der Gesamtheit als auch innerhalb der Halbschwestergruppen untersucht.

RESUME

Les auteurs examinent l'âge au troisième vêlage, l'interval moyenne entre vêlages et le nombre moyenne des services pour vêlage, aux fins d'éffectuer un contrôle sur la fertilité de l'exploitation pour leur utilization dans la sélection.

Les auteurs, par 10 groups de demi-soeurs, calculent les coéfficients d'héritabilité des sous nommés paramètres et étudient les corrélations intercurrentes entre eux sur le total et à l'interieur de chaque groupe.