EXTENDING PART LACTATIONS

Extensión de Datos sobre Lactationes parciales

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Extending part lactations to a total lactation is important in order to increase the accuracy of sire evaluation and to take into account low producing heifers which are culled before the end of their lactation. Without extending part lactations, these low producers would not be considered in sire evaluation, and this would result in an overestimation of the breeding value of their sires.

There are two classes of methods for extending part lactations in the literature, the regression method and the method of ratio factors. Regression coefficients and ratio factors are found to be dependent on various environmental factors. Age, lactation number, calving interval and in a few cases herd level are taken into account in extending procedures.

Data

Monthly tests and the corresponding 305-day-records of Simmental heifers were used to examine different methods of extending part lactations. For each heifer the following criteria had to be available: a complete lactation of 275 to 305 days, 9 succeeding test days, age at first calving, calving season and the herd average of milk yield. The interval between calving and first test had to be less than 46 days. From 56 000 heifers only 24 000 could be used according to these conditions.

Environmental effects on extending coefficients

In order to examine the influence of age at first calving, season and herd level on the extending factors the data were subdivided into 3 groups of age, 3 seasons and 3 herd levels. The classes were defined as follows:

age at first calving	1	18 - 27 months
	2	28 - 32 months
	3	33 - 42 months
season	1	October - March
	2	April - May
	3	June - September

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	1	herd average > 200 kg
herd level	2	herd average between 200 and - 200 kg
	3	herd average < - 200 kg

From these groups result 27 subgroups for every age-season-herd level combination. By a linear regression method which is described below as "method 1" extending factors were estimated for milk yield, fat yield and fat percentage within the 27 subgroups and for the total data set. Average coefficients were then calculated out of the 27 values for the 3 age classes, the 3 season classes and the 3 herd level classes.

It turned out that herd level had the greatest effect on the coefficients of the traits milk and fat yield. This result was confirmed by analyses of variance which were calculated on the basis of the 27 coefficients. Examples of such ANOVA's are given in table 1. On the basis of these results it was decided to neglect age and season but to use 5 instead of 3 classes of herd level for the comparison of different extending methods.

Table 1: Analyses of variance for extending factors for different part lactations (milk yield)

Source	d.f.	F - statistic (rounded)			
		Test 1	Test 2	Test 3	Test 9
Season (S)	2	0	0	1	5*
Age (A)	2	0	1	1	5
Herd level (H)	2	51**	34**	41**	29**
SA	4	0	0	0	1
SH	4	0	0	1	0
AH	4	0	0	1	2
Error	8				

* P = 0,05, ** P = 0,01

For the trait fat percentage the results were different: The ANOVA's showed nearly no significant F-value and the differences between the coefficients were very small. Therefore all environmental factors were neglected in the further computations.

Comparison of different methods

The following methods of extending part lactations were applied in order to estimate the total lactation performace on the basis of one up to nine test days. Method 2 and 3 were only applied to the traits milk yield and fat yield. The coefficients of method 4 were not estimated in this investigation but taken over as they have been used routinely in Baden-Württemberg since 1972.

(1) Linear regression on the average test-day performance (SCHLOTE, 1972)

$$\hat{Y} = \hat{a} + \hat{b}\, X_T$$

$\hat{a}$ and $\hat{b}$ are estimated intercept and regression coefficient

X_T is the mean performance of the tests of the part lactation

$\hat{Y}$ is the estimated 305-day performance

(2) Ratio factor (AURAN, 1976)

$$\hat{Y} = X_P + k\, X_{LT}$$

X_P is the accumulated yield of part lactation

X_{LT} is the yield of last test-day

k is the population average of $\frac{Y - X_P}{X_{LT}}$

Y is the 305-day performance

(3) Modified method 2 (AURAN, 1976)

$$\hat{Y} = X_P + k'\, X_{LT} \qquad , k' = c\, Z$$

c = linear regression of k on Z

Z = number of month in the remaining part of the lactation

(4) This method was developed by SCHLOTE (1972) and has been used routinely up to now. The coefficients were not estimated again. A regression model is used as in method 1

$$\hat{Y} = \hat{a} + \hat{b}\, X_D$$

but here X_D is the mean daily performance.

By this method the varying number of days between the test should be taken into account.

Methods 1, 2 and 3 were used within 5 herd-level classes according to the results given above. Method 4 was used within 2 calving seasons (September to February and March to April) as suggested by SCHLOTE.

The different methods were compared by (a) the correlation between the estimated and observed 305-day performance and (b) the mean and (c) the standard deviation of the differences between estimated and observed 305-day performances. The results are given in tables 2 and 3 for the traits fat yield and fat percentage.

Method 1, applied within herd levels, proves to be the best one. It has the highest correlations and the smallest biases. The correlations of the overall regression method are about the same as those of the methods using ratio factors, and the method after SCHLOTE.
Methods 2 to 4 yield biased results.

Table 2: Comparison of methods for the trait fat yield

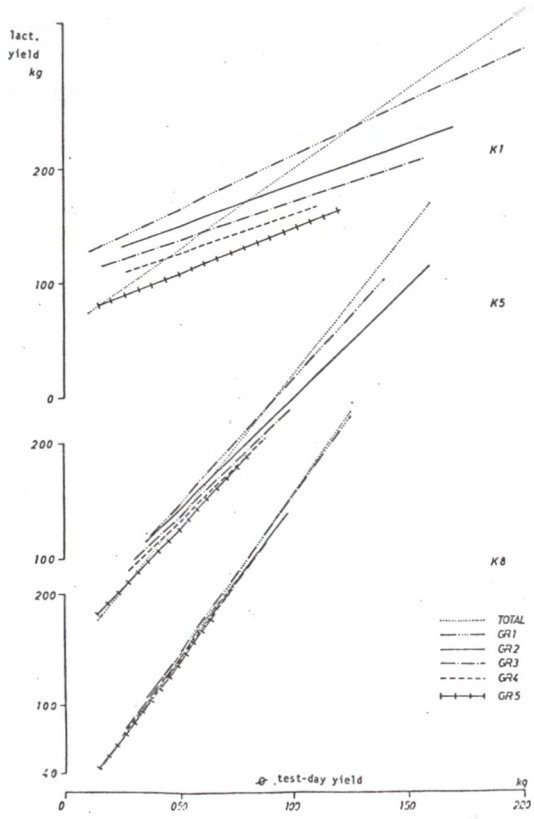
test	overall regression	(1) regression within herd levels	(2) ratio factor k	(3) ratio faktor k'	(4) method after SCHLOTE,1972
	correlations $(y,\hat{y})$				
1	.72	.88	.77	.75	.73
2	.82	.91	.83	.83	.83
3	.88	.93	.88	.88	.88
4	.92	.94	.93	.92	.92
5	.94	.96	.94	.94	.94
6	.96	.97	.96	.96	.96
7	.97	.98	.97	.97	.97
8	.98	.98	.98	.98	.98
9	.99	.99	.99	.99	.99

means and standard deviations of $Y - \hat{Y}$

	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s
1	0	17	-5	30	16	32	-6	24
2	0	15	4	24	8	24	-4	20
3	0	13	3	19	1	19	-3	17
4	0	12	2	16	-2	15	-1	14
5	0	11	1	13	-3	13	0	12
6	0	9	1	11	-3	10	0	10
7	0	8	1	9	-3	8	1	9
8	0	6	0	7	-2	7	1	7
9	0	5	0	5	-1	5	0	6

The regressions within herd levels (method 1) are shown in graph.1. It is clear from this diagram that herd level should be taken into account. Obviously the total lactation is much more influenced by herd level than the performance at the beginning of the lactation of heifers.

Graph. 1: Regressions lines within herd levels and overall for fat yield



The correlations for the trait fat percentage are presented in table 3. The accuracy of both methods which were applied to this trait is very similar.

Table 3: Correlations between estimated and observed lactation record for fat percentage

test	overall regression	method after SCHLOTE (1972)
1	.70	.70
2	.78	.80
3	.85	.86
4	.89	.89
5	.93	.92
6	.95	.94
7	.97	.97
8	.98	.99
9	.98	.99

SUMMARY

Three methods for extending part lactations which are suggested in the literature and also the conventional method in Baden-Württemberg were tried on data of 24 000 Simmental heifers of the years 1978/79. The effects of calving season, age at first calving and herd level (average milk yield) on the regression coefficients of the extension procedure were analysed. - Herd level had the greatest influence on the coefficients. Of the four methods applied the linear regression - within 5 herd level classes - on the average of the existing monthly records turned out to be the most accurate one. The correlations between individual test and 305 day-lactation of fat yield ranged from .88 for the first test to .99 for the 9. test.

RESUMEN

Se evaluó datos de 24 000 novillas Simmental de los años 1978/79 segun tres métodos para la extensión de lactaciónes parciales recomendadas en la literatura tanto como el método convencional del estado de Baden-Württemberg. Se analizó los efectos de estación e edad de la primera parición y promedio de rendimiento lechero del rebaño en las coeficientes de regresión del procedimiento de extensión. - El efecto que mas influía a los coeficientes era el promedio de rendimiento del rebaño. De los cuatro métodos aplicados la regresión lineál - dentro de cinco clases de rendimiento de rebaño - en el promedio de los datos mensuales existentes comprobó como el mas adecuado. Las correlaciónes entre las pruebas singulares y el rendimiento de grasa láctea de 305 días de lactación se hallaban entre .88 para la primera prueba y .99 para la novena.