J. Anim. Breed. Genet. 107 (1990) 43–51
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ISSN 0931–2668

Ms. received 1. 2. 1989

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Analysis of milk production traits of Pinzgauer cattle in Austria

II. Genetic parameters

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Introduction

A main goal of dairy cattle breeders is to increase milk yield and its components through selection. In recent years, profits from milk sales have been dependent on protein and fat contents (Dommerholt and Wilmink 1986). Therefore, estimates of genetic and phenotypic parameters of milk traits are required for estimating breeding valves of animals, for formulating on efficient breeding system and for evaluating genetic gains.

The present study was undertaken to estimate the genetic and phenotypic variation and covariation of and between 100-day and 305-day yield and percentage milk traits of the first two lactations of Pinzgauer cattle in Austria.

Materials and methods

Data in the present study consisted of 19754 first and second lactation milk records of Pinzgauer cows collected by the Official Federation of Austrian Cattle Breeders (ZAR) over ten consecutive calving years (1974 through 1983). Soliman et al. (1989) give a detailed description of the material, management and breeding plan of such population. Genetic and phenotypic analyses of cow productivity traits were carried out on the first two lactation records of 12338 and 7416 daughters (paternal half-sisters) produced by 1614 and 1144 sires, respectively. Traits examined were 100-day milk yield (100dMY), 305-day milk yield (305dMY), 100-day fat yield (100dFY), 305-day fat yield (305dFY), 100-day protein yield (100dPY), 305-day protein yield (305dPY), 100-day fat percent (100dF), 305-day fat percent (305dF), 100-day protein percent (100dP) and 305-day protein percent (305dP).

The same mixed linear model described by Soliman et al. (1989) which included the effects of sire, month of calving, year of calving, age at calving and days open was used to analyse the present data. Harvey's (1977) mixed model computer program was employed in analyzing the data. Estimates of sire and remainder components of variance and covariance were computed according to Method III of Henderson (1953). Paternal half-sib heritability (h^2) estimates were calculated as four times the ratio of σ^2s (sire variance component) to the sum of σ^2s and σ^2e (remainder variance component). Approximate standard errors for h^2 were computed according to Swiger et al. (1964). Estimates of genetic (with standard errors) and phenotypic correlations were obtained by computing techniques described by the LSML76 program of Harvey (1977). The expected direct and correlated responses per generation from single-trait selection for milk traits studied were estimated according to Falconer (1981).

Results and discussion

Means and variation of uncorrected records

Means and coefficients of variation (CV) of milk yield and composition traits, based on uncorrected data, in the first two lactations are given in Table 1. Means of yield traits of the

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first two lactations in valley-pastured cows were higher than the corresponding means in mountain-pastured cows. The Austrian studies attributed these results to the fact that, in valley-pasture regions, green fodder for lactating cows are available in sufficient quantity than on mountain pastures. Availability of concentrates and more favorable weather in valley-pature regions could be added as other causes. However, the mean yields in 100 and 305 days in milk reported here generally fall within the range of estimates obtained from Pinzgauer cattle in most of the Austrian studies (e.g. HOLZ 1982; SOLIMAN 1984). As expected, the averages of different yield traits increased from the 1st to the 2nd lactation (Table 1).

For both lactations, CV's in milk traits studied range between 17–24 % for yield traits and between 6–15 % for percentage traits. Similarly, recent Austrian studies (e.g. SOLIMAN 1984; FUCHS 1985) reported higher variation for yield traits than for percentage traits. The CV of fat percentage was higher than that of protein. Similarly, KENNEDY (1982) found that yield traits showed more variability, as measured by CV, than did percentage traits (18–19 % vs 7–9 %).

Sire components of variance

Results obtained in the present study show that the sire of the cow affected significantly ($P < 0.001$) all traits of the first two lactations in both regions studied. Most of these findings are similar to those obtained in other Austrian studies (e.g. SOLIMAN 1984; FUCHS 1985). These findings indicate the possibility of genetic improvement of milk traits through sires selection. The proportion of the variance attributable to the sire component for all milk traits of

Table 1. **Means, coefficients of variations (CV), proportion of the variance attributable to the sire component (V%)+ and heritability estimates (h^2) and their standard errors (S.E.) for milk yield and composition traits of first two lactations in Pinzgauer cattle**

Traits	1st Lactation				2nd Lactation			
	Mean	CV%	V%	$h^2 \pm$ S.E.	Mean	CV%	V%	$h^2 \pm$ S.E.
Valleys-Pastured cows								
Yields (kg):								
100dMY	1277	18	9.1	0.36 ± 0.037	1587	19	11.1	0.45 ± 0.051
305dMY	3149	19	10.1	0.40 ± 0.038	3661	20	10.2	0.41 ± 0.050
100dFY	48	22	7.6	0.30 ± 0.035	59	24	7.4	0.29 ± 0.047
305dFY	124	21	9.8	0.39 ± 0.038	145	22	10.7	0.43 ± 0.051
100dPY	42	20	9.6	0.38 ± 0.054	51	21	7.8	0.31 ± 0.066
305dPY	108	20	10.2	0.41 ± 0.055	125	21	7.5	0.30 ± 0.066
Percentage (%):								
100dF	3.7	12	2.1	0.08 ± 0.028	3.7	15	1.1	0.05 ± 0.037
305dF	3.9	9	5.5	0.22 ± 0.033	3.9	9	6.9	0.28 ± 0.046
100dP	3.1	8	5.1	0.21 ± 0.047	3.1	8	4.5	0.18 ± 0.060
305dP	3.3	6	7.7	0.31 ± 0.051	3.2	7	4.4	0.18 ± 0.060
Mountain-Pastured cows								
Yields (kg):								
100dMY	1247	17	12.9	0.52 ± 0.051	1526	18	9.0	0.36 ± 0.063
305dMY	3113	17	11.8	0.47 ± 0.049	3570	18	8.1	0.32 ± 0.062
100dFY	47	21	10.2	0.41 ± 0.048	57	23	6.0	0.24 ± 0.059
305dFY	123	19	10.0	0.40 ± 0.047	141	20	5.6	0.22 ± 0.058
100dPY	40	19	11.8	0.47 ± 0.064	49	20	7.1	0.28 ± 0.075
305dPY	105	19	10.1	0.40 ± 0.061	119	19	6.1	0.24 ± 0.073
Percentage (%):								
100dF	3.7	12	5.0	0.20 ± 0.041	3.8	14	2.8	0.11 ± 0.054
305dF	3.9	8	9.2	0.37 ± 0.046	4.0	9	7.6	0.30 ± 0.061
100dP	3.1	8	4.4	0.18 ± 0.052	3.1	8	4.1	0.16 ± 0.070
305dP	3.2	6	9.0	0.36 ± 0.060	3.2	6	8.4	0.34 ± 0.077

+ Sire effect was significant ($P < 0.001$) for all traits studied.

the mountain-pasture set are generally larger than the corresponding variances for the valley-pasture set.

Heritability estimates

Estimates of heritability (h^2) for yield traits in the 1st lactation ranged from 0.30 to 0.41 in the valley-pasture set and from 0.40 to 0.52 in mountain-pastured cows (Table 1). However, estimates of h^2 for yield traits are slightly higher than those estimates reported in the Austrian and other central Europe studies (e. g. KARRAS and SCHLOTE 1982; PAPE et al. 1983; ROMBERG et al. 1983; SEYKORA and MCDANIEL 1983; ALPS et al. 1984; GRAML et al. 1987; NEIMANN-SORENSEN et al. 1987). The higher estimates of h^2 for yield traits in present Pinzgauer data as compared to corresponding estimates of previous studies indicate a relatively larger contribution of additive genetic variance. This agrees with previous studies reported earlier (SOLIMAN 1984). This may be due to the fact that this breed has not been subjected to intensive selection. Heritabilities of percentage traits in the 1st lactation ranged from 0.08 to 0.31 and from 0.18 to 0.37 in the two data sets, respectively (Table 1). Estimates of h^2 for percentage traits are lower than their corresponding estimates commonly reported (e. g. PAPE et al. 1983; SCHNEEBERGER and HAGGER 1983; ALPS et al. 1984; GRAML et al. 1987; NEIMANN-SORENSEN et al. 1987).

Table 2. Genetic correlations (r_G) with standard errors (S.E.) and phenotypic (r_P) correlations⁺ for milk traits of 1st lactation in Pinzgauer cattle

Traits	Valley-pastured cows			Mountain-pastured cows		
	r_G	S.E.	r_P	r_G	S.E.	r_P
100dMY & 305dMY	0.96	0.011	0.87	0.96	0.011	0.88
305dFY	0.93	0.018	0.78	0.92	0.021	0.79
305dPY	0.95	0.019	0.83	0.98	0.017	0.85
305dF	0.06	0.092	−0.05	−0.12	0.086	−0.07
305dP	−0.06	0.112	−0.01	−0.05	0.109	0.01
100dFY & 305dMY	0.92	0.024	0.72	0.85	0.031	0.72
305dFY	0.96	0.016	0.82	0.95	0.016	0.83
305dPY	0.96	0.028	0.74	0.89	0.033	0.76
305dF	0.30	0.088	0.36	0.22	0.086	0.36
305dP	0.06	0.119	0.15	0.08	0.115	0.16
100dPY & 305dMY	0.89	0.027	0.79	0.92	0.024	0.81
305dFY	0.93	0.027	0.77	0.97	0.022	0.80
305dPY	0.96	0.017	0.86	0.98	0.014	0.88
305dF	0.11	0.139	0.10	0.12	0.112	0.10
305dP	0.22	0.107	0.32	0.15	0.110	0.33
305dMY & 305dFY	0.95	0.009	0.91	0.91	0.016	0.89
305dPY	0.96	0.008	0.95	0.96	0.010	0.95
100dF	0.09	0.133	−0.02	−0.13	0.110	−0.03
100dP	0.01	0.125	0.01	0.00	0.148	0.03
305dF	0.03	0.089	−0.04	−0.24	0.089	−0.09
305dP	−0.14	0.108	0.00	−0.21	0.113	−0.01
305dFY & 305dPY	0.98	0.010	0.91	0.95	0.014	0.91
100dF	0.35	0.122	0.29	0.25	0.107	0.31
100dP	0.15	0.128	0.13	0.27	0.148	0.18
305dF	0.33	0.079	0.37	0.18	0.088	0.37
305dP	0.03	0.113	0.16	0.03	0.119	0.18
305dPY & 100dF	0.26	0.192	0.09	−0.01	0.149	0.09
100dP	0.28	0.120	0.26	0.24	0.145	0.30
305dF	0.06	0.137	0.11	−0.06	0.118	0.08
305dP	0.14	0.109	0.31	0.08	0.119	0.32
305dF & 305dP	0.63	0.114	0.39	0.68	0.128	0.34

⁺ Estimates of correlations presented here are only those to be used to select for 305-day lactation through 100-day lactation.

The relatively low estimate of h^2 for percentage traits (Table 1) could be explained on the basis of error component of variance (σ^2e) inflated upward while a downward estimate in sire component of variance (σ^2s) were obtained. This inflation in σ^2e for percentage traits could be attributed to the effects of some nongenetic factors (e. g. gestation length, preceding dry period ...); such effects were not considered in collecting the present data. Intensive selection for percentage traits in the recent years could be added as another cause in this respect.

In the 2nd lactation, estimates of h^2 (Table 1), for most traits were lower than those estimates of the 1st lactation in both regions as reported in many European studies (e. g. KARRAS and SCHLOTE 1982; CASSEL and MCDANIEL 1983; PAPE et al. 1983; ROMBERG et al. 1983; ALPS et al. 1984; NEIMANN-SORENSEN et al. 1987). This may be due to that the additive genetic variance did not increase much for most traits from the first to the second lactation, but environmental variation increased relatively more due to environmental factors having a cumulative effect over succeeding lactations as suggested by BARKER and ROBERTSON (1966) and others. Another reason for such difference may be selection, based on culling policies, which was commonly applied by dairy cattle breeders in the 2nd lactation (BAR-ANAN et al. 1983).

Correlations

Genetic, (r_G) and phenotypic (r_P) correlations among yield and percentage traits in the first two lactations are presented in Tables 2 and 3. In the present study, estimates of r_G between

Table 3. **Genetic correlations (r_G) with standard errors (S.E.) and phenotypic (r_P) correlations+ for milk traits of 2nd lactation in Pinzgauer cattle**

Traits	Valley-pastured cows			Mountain-pastured cows		
	r_G	S.E	r_P	r_G	S.E	r_G
100dMY & 305dMY	0.96	0.014	0.87	0.91	0.028	0.86
305dFY	0.91	0.023	0.79	0.88	0.051	0.78
305dPY	0.93	0.032	0.84	0.89	0.052	0.83
305dF	0.15	0.104	0.04	−0.25	0.140	−0.01
305dP	−0.10	0.183	0.01	−0.14	0.176	−0.01
100dFY & 305dMY	0.99	0.044	0.60	0.82	0.075	0.65
305dFY	1.06	0.035	0.67	1.03	0.058	0.73
305dPY	1.14	0.119	0.53	0.94	0.097	0.63
305dF	0.52	0.097	0.35	0.25	0.151	0.33
305dP	0.21	0.242	0.08	0.27	0.188	0.10
100dPY & 305dFY	0.93	0.040	0.78	0.84	0.086	0.75
305dPY	0.96	0.027	0.86	0.90	0.049	0.85
305dF	0.29	0.183	0.14	−0.07	0.182	0.13
305dP	0.13	0.193	0.30	0.12	0.179	0.31
305dMY & 305dFY	0.95	0.012	0.91	0.90	0.034	0.89
305dPY	0.98	0.011	0.95	0.94	0.024	0.94
100dF	0.24	0.266	−0.10	−0.23	0.230	−0.04
100dP	−0.10	0.191	0.00	−0.26	0.250	−0.02
305dF	0.17	0.107	0.01	−0.41	0.150	−0.03
305dP	−0.15	0.195	−0.03	−0.35	0.188	−0.05
305dFY & 305dPY	0.98	0.017	0.91	0.90	0.048	0.90
100dF	0.75	0.339	0.12	0.36	0.259	0.22
100dP	−0.02	0.193	0.12	−0.03	0.291	0.12
305dF	0.47	0.084	0.43	0.04	0.174	0.42
305dP	0.01	0.195	0.12	−0.07	0.215	0.13
305dPY & 100dP	0.10	0.195	0.23	0.06	0.260	0.24
305dF	0.26	0.187	0.12	−0.24	0.189	0.11
305dP	0.07	0.200	0.27	0.00	0.198	0.28
305dF & 305dP	0.52	0.192	0.37	0.61	0.129	0.38

\+ Estimates of correlations presented here are only those to be used to select for 305-day lactation through 100-day lactation.

yield traits were higher than the phenotypic ones which disagrees with some other investigators (e. g. KARRAS and SCHLOTE 1982; PAPE et al. 1983; MANFREDI et al. 1984; SIMIANER and PABST 1984; NEIMANN-SORENSEN et al. 1987).

The genetic correlations between yield traits (Tables 2 and 3) were positive and high (≥0.85). Estimates of r_G between milk, fat and protein yields were similar to those of HARGROVE et al. (1981), de JAGER and KENNEDY (1987), NEIMANN-SORENSEN et al. (1987). These mainly part-whole genetic relationships indicate that milk, fat and protein yields in 100-day of lactation can be good indicators of production in 305-days of lactation. Most of the estimates in the literature (e. g. RENDEL et al. 1957) showed that the genetic correlations between initial yield traits and 305-day in milk traits were positive and generally high.

Estimates of r_G obtained in the present study between percentage traits are also positive and relatively ranging between 0.52 and 0.68 for the first two lactations (Tables 2 and 3). The positive and high r_G between milk percentage traits are similar to those obtained by many European investigators (e. g. HILL et al. 1983; NEIMANN-SORENSEN et al. 1987).

Genetic correlations between yield and percentage traits are fairly low and variable in sign (Tables 2 and 3). The standard errors of these correlations are approximately twice the estimate itself and can be regarded as zero estimates as reported by some European investigators (e. g. BLAU and SCHOLZ 1982; ALPS et al. 1984; SOLIMAN 1984) on Fleckvieh cattle and consequently they were not sensibly discussed. All percentage traits are positively correlated with fat yield which are similar to those reported by MAIJALA and HANNA (1974). Estimates of r_G between fat percentage and fat yield are positive and relatively high as reported earlier in many European studies (e. g. PAPE et al. 1983) while a low estimate of −0.16 between protein percentage and protein yield was obtained. However, in other

Table 4. **Expected direct and correlated response⁺ per generation from single-trait selection for 305-day milk, fat, and protein yields**

Criterion of selection	Item[1]	Expected genetic change (kg)⁺⁺					
		Valley-pastured cows			Mountain-pastured cows		
		305dMY	305dFY	305dPY	305dMY	305dFY	305dPY
100dMY	a	114.0(152.0)	5.0(6.0)	4.0(5.0)	131.0(102.0)	5.0(4.0)	4.0(3.0)
	b	3.6(4.1)	4.1(4.1)	3.7(3.2)	4.2(2.9)	4.1(2.8)	3.8(2.5)
100dFY	a	100.0(127.0)	4.0(6.0)	4.0(4.0)	103.0(75.0)	5.0(3.0)	4.0(3.0)
	b	3.2(3.5)	3.2(4.1)	3.7(3.2)	3.3(2.1)	4.1(2.1)	3.8(2.5)
100dPY	a	109.0(121.0)	5.0(6.0)	4.0(4.0)	120.0(79.0)	5.0(3.0)	4.0(3.0)
	b	3.5(3.3)	4.1(4.1)	3.7(3.2)	3.8(2.2)	4.1(2.1)	3.8(2.5)
305dMY	a	<u>125.0(151.0)</u>	5.0(6.0)	4.0(4.0)	<u>130.0(105.0)</u>	5.0(3.0)	4.0(3.0)
	b	4.0(4.1)	4.0(4.1)	3.7(3.2)	4.2(2.9)	4.1(2.1)	3.8(2.5)
305dFY	a	117.0(147.0)	<u>5.0(7.0)</u>	4.0(4.0)	109.0(79.0)	<u>5.0(3.0)</u>	4.0(2.0)
	b	3.7(4.0)	4.0(4.5)	3.7(3.2)	3.5(2.2)	4.1(2.1)	3.8(1.7)
305dPY	a	121.0(126.0)	5.0(6.0)	<u>5.0(4.0)</u>	116.0(86.0)	4.0(3.0)	<u>4.0(3.0)</u>
	b	3.8(3.4)	4.0(4.1)	4.6(3.2)	3.7(2.4)	3.2(2.1)	3.8(2.5)
100dF	a	5.0(12.0)	1.0(2.0)	1.0(0.0)	−11.0(−14.0)	1.0(1.0)	0.0(1.0)
	b	0.2(0.3)	0.8(1.4)	0.9(0.0)	0.3(−0.4)	0.8(0.7)	0.0(0.8)
100dP	a	1.0(−10.0)	1.0(0.0)	1.0(0.0)	0.0(−19.0)	1.0(0.0)	1.0(0.0)
	b	0.0(0.3)	0.8(0.0)	0.9(0.0)	0.0(−0.5)	0.8(0.0)	1.0(0.0)
305dF	a	3.0(21.0)	1.0(3.0)	0.0(1.0)	−28.0(−42.0)	1.0(0.0)	0.0(−1.0)
	b	0.1(0.6)	0.8(2.1)	0.0(0.8)	0.9(−1.0)	0.8(0.0)	0.0(−1.0)
305dP	a	−15.0(−15.0)	0.0(0.0)	1.0(0.0)	−24.0(−38.0)	0.0(0.0)	0.0(0.0)
	b	0.5(0.4)	0.0(0.0)	0.9(0.0)	0.8(−1.0)	0.0(0.0)	0.0(0.0)

+ Direct (underlined) and correlated response in the 2nd lactation are given in brackets adjacent to the response in the 1st lactation; ++ selection differential equals 1.0 standard deviation for selection on single trait, on female side; no selection on male side; [1]where a = response in actual units of measurements (kg) and b = response (a) per generation as expressed as a percentage of the overall mean of the trait.

investigations both protein percentage and fat percentage had highly positive correlations with protein yield and fat yield (e. g. DE JAGER and KENNEDY 1987).

Prediction of response to selection

The expected direct and correlated responses per generation from single-trait selection, on females, for 305-day of milk, fat and protein yields are summarized in Table 4. These estimates are to be used to assess the relative effect of direct and indirect selection alternatives. Direct selection on a single trait resulted in greater advances in the desired direction than indirect selection for 305dMY and 305dPY of the 1st lactation and 305dFY of the 2nd lactation in valley-pastured cows and only for 305 dMY of the 2nd lactation under alpage. While, in most cases, direct and indirect selection are nearly the same, selection emphasis and 100dMY results in largest response of 305 dFY of the 2nd lactation under alpage. The reason for this large response is due to the high heritability estimate of the former trait and the high genetic correlation between the two traits.

Selection for increasing any of 305-day yield traits would result in increases in the other yield traits (Table 4). Therefore, selection for increasing protein yield, for instance, would result in increased fat and milk yields. Similarly, KENNEDY (1982) and DE JAGER and KENNEDY (1987) reported that selection for any yield traits would tend to increase the others.

Selection for increasing 100 days yield in milk would lead to increased 305-day yield nearly as much as selecting directly (Table 4). Therefore, it can be concluded that genetic improvement in yield traits could be based on 100 day yields. Such procedure will lead to a decrease in generation interval and consequently to increased genetic gain per year, while direct selection for increasing either of percentage traits would be accompanied by small changes in 305-day yield traits (Table 4).

General discussion

From the relatively high estimates of heritability for milk traits in Pinzgauer cattle reported herein, it can be concluded that genetic improvement of milk yield traits can be achieved through selective breeding. This gives encouragement for Pinzgauer cattle breeders to improve milk traits of their breed through selection. Increasing percentage traits by means of selection will be somewhat slower than for yield traits. High estimates of genetic and phenotypic correlation in the present study offer the possibility to select for yield traits as early ages, i. e. at 100 days of lactation.

Acknowledgements

The authors are grateful to professor E.S.E. GALAL, Department of Animal Production, Faculty of Agriculture, Ain Shams University, Cairo, Egypt for helpful comments and for reading the manuscript. We gratefully acknowledge the Official Federation of Austrian Cattle Breeders (ZAR) for Supplying the data.

Summary

Genetic analysis of productivity traits in Pinzgauer cows was carried out on data described in part I. A total of 12338 and 7416 daughters (paternal half-sisters) by 1614 and 1144 sires in the first and second lactations, respectively, were used to estimate the genetic and phenotypic variation and covariation of and between 100-day and 305-day yield and percentage milk traits.

Means of milk traits in valley-pasture regions were higher than corresponding ones under alpage. The coefficients of variation (CV) of yield traits were nearly twice as large as the CV of percentage traits. The CV of fat percentage was relatively high compared with that of protein. The sire of cow affected ($P < 0.001$) all milk traits studied. Estimates of heritability in the 1st lactation were ranged from 0.30 to 0.52 for yield traits and from 0.08 to 0.37 for percentage traits. Generally, estimates of heritability for milk traits in the 2nd lactation were lower than the corresponding estimates in the 1st lactation. Genetic and phenotypic correlations between yield traits were positive and high. Genetic correlations between percentage traits were positive and relatively high while estimates between yield and percentage traits were fairly low and variable in sign. Selection for improving 100-day yield traits would improve 305-day yields nearly as much as direct selection on the yield of 305 days. The expected direct responses of yield traits were much larger than the indirect response due to selection for percentage traits. Possibility of improvement of Pinzgauer cattle, therefore, are much better for yield traits than in percentage traits.

Résumé

Analyse des caractères de la production laitière du bovin Pinzgauer en Autriche. II. Facteurs génétiques.

Une analyse des caractères productifs de vaches Pinzgauer était réalisée de 1974 à 1983 dans les régions montagneuses et vallées de Salzbourg. L'analyse considère 12.338 et 7.416 vaches (demi-soeurs paternelles) produites par 1614 et 1144 taureaux dans la première et deuxième lactation pour estimer la variation génétique et phénotypique et la covariation de et entre les rendements journaliers de 100 et 305 jours et le pourcentage des caractères laitiers. La moyenne des caractères laitiers dans les pâtures des vallées était plus élevée que celle des pâtures alpestres. Les coéfficients de variation (CV) des caractères de rendement étaient presque deux fois plus grands que le CV du pourcentage des caractères. Le CV de la teneur en graisse était relativement élevé comparé à celui de la protéine. L'influence du taureau (père) était hautement significative ($P < 0.01$) sur tout les caractères examinés. L'estimation de l'héritabilité de la première lactation se trouve entre 0.30 à 0.52 pour les caractères de rendement et de 0.08 à 0.37 pour les caractères laitiers. Généralement, les estimations de l'héritabilité pour caractères laitiers dans la seconde lactation étaient plus basses que celles dans la première lactation. Les corrélations génétiques et phénotypiques entre les caractères de rendement étaient positives et élevées. Les corrélations génétiques entre caractères laitiers étaient positives et relativement élevées, tandis que les valeurs estimées des corrélations entre les caractères de rendement et laitiers étaient les uns positives, les autres légèrement négatives. Une sélection pour l'amélioration du rendement à 100 jours améliorerait plutôt le rendement à 305 jours, exactement comme lors d'une sélection directe du rendement à 305 jours. Les réactions directes supposées des caractères du rendement étaient nettement plus grandes que les réactions indirecte dues à la sélection pour pourcentage des caractères laitiers. Les possibilités d'amélioration du bovin Pinzgauer sont pour cela meilleurs pour les caractères du rendement qu'en pourcentage des caractères laitiers.

Resumen

Analisis de caracteristicas productivas lecheras en ganado lechero Pinzgauer en Austria. II. Parametros geneticos

Se realizó un análisis genético en características productivas lecheras en vacas Pinzgauer entre el periodo de 1974 y 1983 en las regiones de Salzburgo (Austria) en praderas del valle y de los alpes montañosos. Los datos utilizados en el análisis fueron 12.338 y 7.416 vacas, como hijas (medias hermanas paternas) de 1.614 y 1.144 toros en la primera y segunda lactancia, respectivamente, con el fin de estimar los componentes genéticos y fenotípicos de varianza y covarianza, entre 100 y 305 días de producción sobre la cantidad de leche producida y los componentes en la leche. Los promedios de producción de leche y sus componentes en la leche de las vacas mantenidas en las praderas del valle fueron mayores que la producción de las vacas en praderas alpinas. Los coeficientes de variación (CV) de producción de leche fueron casi dos veces mayores que el coeficiente de variación de los componentes en la leche. El CV del porcentaje de grasa fue relativamente mayor comparado con el de proteína. El componente paterno fue ($P < 0,001$) significativamente importante sobre todas las características estudiadas. La estimación de heredabilidad en la primera lactancia para producción fue de 0,30–0,52 y para los componentes en la leche fue de 0,08 a 0,37. En general estas estimaciones fueron menores para la segunda lactancia en comparación con la primera lactancia. Las correlaciones genéticas y fenotípicas entre producción de leche fueron altas y positivas. Las correlaciones genéticas entre los componentes en la leche fueron positivas y relativamente altas, mientrás que las estimaciones de las correlaciones entre producción y los componentes de la leche fueron en parte positiva y en parte levemente negativas. Una selección para mejorar la producción a los 100 días podrían mejorar tanto o igual que si se selecciona a los 305 días directamente. La respuesta esperada directa de características productivas fue mucho mayor que la respuesta indirecta si se selecciona por características de porcentaje. Posibilidades de mejoramiento del bovino lechero Pinzgauer sin embargo, son mucho mejor por características productivas que sobre característica de porcentaje.

Zusammenfassung

Analyse der Milchproduktionsleistung des Pinzgauer Rindes in Österreich. 2. Genetische Parameterschätzung

Eine genetische Analyse der Milchleistungsmerkmale der Pinzgauer Kühe im Zeitraum von 1974 bis 1983 in Gebirgs- und Talregionen des Salzburger Landes wurde durchgeführt. Die Datenanalyse

berücksichtigt 12338 und 7416 Kühe, die als Töchter (Väterliche Halbgeschwister) von 1614 und 1144 Stieren in der ersten bzw. zweiten Laktation gezeugt worden sind, um die genetischen und phänotypischen Varianz- und Kovarianzkomponenten für und zwischen 100- und 305-Tageleistungen der Mengenmerkmale und Milchinhaltsstoffe schätzen zu können. Der Durchschnitt der Milchleistungsmerkmale für die Heimkühe war höher als die entsprechenden Merkmale bei Alpkühen. Die Variationskoeffizienten (CV) der Mengenmerkmale waren fast zweimal so groß wie die Variationskoeffizienten der Milchinhaltsstoffe. Der Variationskoeffizient des Fettgehaltes war verhältnismäßig höher als beim Eiweißgehalt. Der Einfluß des Stieres (Vaters) war höher signifikant ($P < 0.01$) auf alle untersuchten Merkmale. Die Heritabilitätsschätzung der ersten Laktation liegt für die Mengenmerkmale zwischen 0.30–0.52 und zwischen 0.08–0.37 für die Milchinhaltsstoffe. Im allgemeinen wurden für die zweiten Laktationsleistungen niedrigere h^2-Werte geschätzt als für die ersten Laktationen. Die genetischen und phänotypischen Korrelationen zwischen den Mengenmerkmalen waren hoch positiv. Die genetischen Korrelationen zwischen den Milchinhaltsstoffen waren positiv und verhältnismäßig hoch, während die geschätzten Werte der Korrelationen zwischen den Mengenmerkmalen und Milchinhaltsstoffen teils positiv, teils schwach negativ eingeschätzt wurden. Eine Selektion zur Verbesserung der 100-Tageleistungen der Mengenmerkmale würde eher zu einer Verbesserung der 305-Tageleistungen überleiten, genau soviel wie bei einer direkten Selektion der 305-Tageleistung. Die erwarteten direkten Reaktionen der Mengenmerkmale waren wesentlich größer als die indirekten Reaktionen von der Selektion der Milchinhaltsstoffe. Die Verbesserungsmöglichkeiten der Pinzgauer Kühe sind deswegen höher bei den Mengenmerkmalen als bei den Milchinhaltsstoffen.

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