DAIRY BREED COMPARISON IN EAST AND SOUTHERN AFRICA (KENYA - ZIMBABWE STUDIES)

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SUMMARY

The Kenya milk records, for the period 1975-85 collected from 6 herds, and Zimbabwe milk records, for the period 1979-86 collected from 8 herds, were analysed to compare the Ayrshire and Friesian breed performance in Kenya and the Holstein-Friesian and Jersey breed performance in Zimbabwe, when reared under identical herd conditions.

From the monetary aspects and taking into consideration the metabolic weights and total dry matter intake of these breeds, it appears that, given the same environment, the Friesians are more profitable than the Ayrshires in Kenya and the Jerseys outperform the Holstein-Friesian in Zimbabwe.

INTRODUCTION

In Kenya and Zimbabwe, as examples of East and Southern Africa countries respectively, many dairy cattle breeding programmes started with imported animals rather than with selection within indigenous populations. In such programmes, there is the question of the extent to which imported cattle can adjust to the new environment. The question of genotype X environment interaction, especially in respect of nutrition, climate and disease, makes it difficult to make accurate comparisons without studies of different breeds/strains from potential sources under conditions in the importing country's environment.

The top two Kenyan dairy breeds, in terms of population size, are the Friesian (F) and Ayrshire (A) breeds. Reports by Kimenye (1973) and Kiwuwa (1974) indicate that both breeds are widely used in the country both in their pure form and in crossbreeding programmes to upgrade the indigenous zebu breeds. In Zimbabwe the Holstein-Friesian (HF) and Jersey (J) are the most common breeds in the dairy industry, making up 75 and 15 percent, respectively, of the official recorded herds.

This study analyses, using official milk records, the Ayrshire and Friesian performance in Kenya, and the Holstein-Friesian and Jersey performance in Zimbabwe, when the breeds are reared under identical herd conditions.

MATERIALS AND METHODS

In this study the official milk records were searched to find herds which kept 10 or more cows of each breed: Ayrshire and Friesian during 1970-85 period in Kenya; and Holstein-Friesian and Jersey during 1979-86 in Zimbabwe. Other than the official record indicating the breed of cow, there was no other proof to show that the cows used in this study were typical of their breeds. Six and eight herds were found to have suitable records for the breed comparison in the Kenyan and Zimbabwean data respectively. The survey data from these herds were of unequal sizes with

total numbers of 518 Ayrshire, 780 Friesian, 693 Holstein-Friesian and 458 Jersey lactations.

In the Kenyan study, the year was divided into four seasons: Season 1 (January-March), Season 2 (April-June), Season 3 (July-September) and Season 4 (October-December). Long rains occur in Seasons 2 and 3, Season 1 is hot and dry and Season 4 gets short rains. In the Zimbabwean data, the year was divided into two seasons: Season 1 (hot and dry, i.e. November to March) and Season 2 (cold and wet, i.e. April to October).

The data were analysed using a paired t-test (Model 1) to compare the breed means across herd-year-season (HYS) environments. The difference, d, between breed 1 and breed 2 means in HYS_j was taken as $d_j = \bar{Y}_{1j} - \bar{Y}_{2j}$, where: $\bar{Y}_{1j}$ is the mean yield for breed 1 in HYS_j and $\bar{Y}_{2j}$ is the mean yield for breed 2 in HYS_j. This difference was then weighted by a factor: $w = n_{1j}n_{2j}/(n_{1j} + n_{2j})$ being a source of heterogeneity from one environment to another. The mean weighted difference $\bar{D}$ averaged over HYS environments was calculated as: $\bar{D} = \Sigma wd/\Sigma w$ and the variance of the weighted difference was computed as:
$\text{Var.}\bar{D} = [\Sigma(d - \bar{D})^2/w^2]/[\Sigma w]^2$. The value for $t = \bar{D}\sqrt{\text{Var.}\bar{D}}$ with degrees of freedom equal to the number of HYS environments.

The analysis of variance, (ANOVA) using the SPSS (1975) statistical package, was done to estimate the effects of breed, season and year and their interactions on performance. Model 2 was used in the Anova.

Model 2 $X_{ijkl} = u + A_i + B_j + C_k + E_{ijkl}$. Where:
X_{ijkl} is the measurement of the trait under study; u is the overall mean; A_i is the discrete effect of breed; B_j is the discrete effect of season; C_k is the discrete effect of year and E_{ijkl} is the random error. The model also included interactions: AB_{ij}, AC_{ik} and BC_{jk}.

RESULTS

The t-test results are shown in Table 1.

The Kenyan data Anova indicated significant differences ($P<0.01$) between breeds in milk yield, lactation length, age at 1st calving and calving intervals. Breeds did not vary significantly ($P>0.05$) in butterfat %. Seasons had non-significant ($P>0.05$) effects in all traits studied. The Zimbabwe data anova showed highly significant ($P<0.01$) differences between breeds in milk yield and butterfat percent, but no significant ($P>0.05$) difference in lactation length and calving interval.

DISCUSSION

The Ayrshire and Friesian milk yields, averaged over the 3 lactations were 2146 and 2639 kg respectively and those of Holstein-Friesian and Jersey averaged over 5 lactations were 4247 and 3321 kg respectively. The equivalent butterfat percentages were: 3.87, 3.81, 3.49 and 4.28 for Ayrshire, Friesian, Holstein-Friesian and Jersey respectively, giving the prices for Holstein-Friesian and Jersey milk Z$0.4160 and Z$0.4432 per litre respectively. The Kenyan milk price does not take into account butterfat percentage and is fixed at Kshs.6 per litre. The average income per lactation based on these yields were Ksh.12,876/-, Ksh.15,834/-, Z$1748.07 and Z$1471.87 for the Ayrshire, Friesian, Holstein-Friesian and Jersey respectively. These give the F:A ratio as 1:0.81 and HF:J as

Table 1: Within HYS comparison, t-test

Variable		Kenyan data			Zimbabw data		
		Mean		Weighted Mean difference ($\bar{D}$)	Mean		Weighted Mean difference ($\bar{D}$)
		A	F		HF	J	
Milk yield (kg)	1st lac.	1912	2341	-429±35**	3803	3123	-680±46**
	2nd lac.	2064	2652	-588±41**	4291	3461	-830±31**
	3rd lac.	2463	2925	-462±36**	4397	3437	-960±46**
	4th lac.	-	-	-	4453	3221	-1232±96**
	≥ 5th lac.	-	-	-	4289	3359	-930±61**
Lac. length (days)	1st lact.	270	270	-8±2.5	286	284	-2±1.5
	2nd lact.	258	271	-13±1.9	284	282	-2±1.3
	3rd lact.	271	272	-1±1.9	281	276	-5±1.3
	4th lact.	-	-	-	283	274	-9±1.7
	≥ 5th lact.	-	-	-	280	270	-10±1.7
Butter fat %	1st lact.	3.88	3.85	-0.03±0.00	3.68	4.04	0.36±0.03*
	2nd lact.	3.86	3.77	-0.09±0.00	3.47	4.64	1.17±0.07**
	3rd lact.	3.88	3.82	-0.06±0.00	3.46	4.48	1.02±0.00*
	4th lact.	-	-	-	3.46	4.34	0.88±0.13*
	≥ 5th lact.	-	-	-	3.38	3.92	0.54±0.04**
Calving int. (days)	1st & 2nd	460	423	37±14*	338	339	1.41±4.22
	2nd & 3rd	458	393	65±17*	375	371	-4.00±3.96
	3rd & 4th	-	-	-	392	382	-9.97±6.83
	4th & 5th	-	-	-	365	372	6.89±5.99
Age at calving (months)	1st cal.	31	33	-	30.10	30.12	-
	2nd cal.	-	-	-	42.41	39.37	-
	3rd cal.	-	-	-	52.66	51.42	-
	4th cal.	-	-	-	65.98	63.34	-

*P<0.05 ** P<0.01

1:0.84. Forbes (1986) gives a simple model for estimating dry matter intake as: TDMI = 0.025 LW + 0.1 MY where: TDMI is the total dry matter intake (kg/d), LW is the live weight (kg) and MY is the milk yield (kg/d). Calculations based on findings in this study (assuming liveweights to be 500, 500, 550 and 400 kg for Ayrshire, Friesian, Holstein-Friesian and Jersey respectively gave, based on TDMI, the A:F ratio as 1:1 and HF:J ratio as 1:0.88. This study indicates that given the same environment, the Friesian is more profitable than Ayrshire in Kenya and the Jersey more profitable than Holstein-Friesian in Zimbabwe.

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