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Short communication

MILK PRODUCTION PERFORMANCE OF JERSEY COWS AT WOLAITA SODO STATE DAIRY FARM, SOUTHERN ETHIOPIA

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ABSTRACT: This study was conducted in Wolaita Sodo State Dairy Farm to determine the milk yield, lactation length and productive herd life of Jersey cattle, and also the potential factors affecting these parameters. The Jersey cattle in the study farm were mainly kept on pastureland and with some supplementary feeds. The result of this study revealed that the overall mean values of milk yield, lactation length and lifetime milk yield were 1691.59 kg, 318.42 days and 5565.19 kg respectively. Milk yield, lactation and lactation length were significantly affected by year of calving and cattle source ($p<0.001$). But lifetime milk yield was only affected by the year of calving ($p<0.01$). Imported cattle had better lactation milk yield and length than those reared on farm. In addition, lactation length was significantly decreasing with parity number ($p<0.001$). The overall mean values for total herd life, productive herd life and effective productive herd life were 2983.74 days, 2310.11 days and 1663.15 days, respectively. Year of birth affected the total and effective productive herd life ($p<0.01$). Imported cattle had longer total ($p<0.01$) and productive herd life ($p<0.05$) than on-farm reared cattle. From this study it can be concluded that Jersey cattle kept in the study farm had low milk yield, but the total herd life, productive herd life and effective productive herd life in general were satisfactory.

Key words: Herd life, Jersey, milk yield, productive herd life

INTRODUCTION

Dairy production is an important part of the livestock production system in Ethiopia. Cattle, camel and goats are the main livestock species that supply milk, with cows contributing 81.2% of the total annual milk out put (Getachew Feleke, 2003). Based on climate, land holdings and integration with crop production as criterion three dairy production systems are recognized in Ethiopia; namely the rural dairy system which is part of the subsistence farming system and includes pastoralists, agro-pastoralists, and mixed crop-livestock producers; the peri-urban; and urban systems (Ketema Hizkias, 2000; Zegeye Yigezu, 2003; Dereje Tadesse *et al*., 2005). The first system contributes to 98%, while the peri-urban and urban dairy farms produce only 2% of the total milk production of the country (Ketema Hizkias, 2000). The per capita milk consumption from domestic source for the country for the year 2000 is 15.3 kg from cows alone and 19 kg when other milk producing species considered (Zegeye Yigezu, 2003). Ethiopia's annual per capita consumption of 19 liters is 49% below the African coverage (Azage Tegegn *et al*., 2006). To this end, many factors have impeded the full exploitation of the cattle resource in Ethiopia. Only very few of Holstein Friesian and Jersey dairy cows or their crosses are seen either in rural or urban area (Kassahun Awgichew, 2004). Improving milk production, therefore, is an important tool for improving food security and sources of income (Rehrahie Mesfin *et al*., 2003).

Wolaita Sodo State Dairy Farm has been operating with Jersey cattle breed for the last twenty years, and information on various traits of the breed has been recorded. However, detailed scientific study about the breed was not made on the performance parameters, and research on Jersey breed in Ethiopia has been sparse. Thus the objective of this study was to evaluate milk yield, productive herd life and herd life of Jersey cattle.

MATERIALS AND METHODS

Study area and study animals

The study was conducted at Wolaita Sodo State Dairy Farm, in Wolaita Zone, Southern Ethiopia; and which is roughly situated at 6°49′ N latitude and 39°47′ E longitude. (WZFEDD, 2003). The mean annual temperature of the area is 19°C; and the average annual rainfall is 1014 mm (NMSA, 2002). The rainfall pattern is characterized as bimodal consisting of short rainy season from March to May and main rainy season from July to October. The study farm was established by Wolaita Agricultural Development Unit (WADU) in 1971, and has a total land area of 115 ha, where there are different farmstead structures and cultivated forge plants. The farm lies at an altitude of 1990 meter above sea level. The feeding management involves grouping of animals based on age, sex and production pattern as calves, growing bulls and heifers, dry and milking cows, heifers and bulls. Feed resources in the farm include natural pasture, Elephant grass, Rhodes grass, Alfalfa, *Stylo species, Siratro*, *Desmodium species* and Lablab. *Lucania species, Sesbania species,* Silage and baled hay were also provided to animals in the farm. All animals, except calves and breeding bulls, graze in the field for seven hours during the day. Cows were hand milked twice daily in their barn.

The study population was the purebred Jersey cattle kept by the farm for the last 20 years. A retrospective study was used to evaluate the milk yield, herd life and productive herd life of the breed in the farm. Recorded data for the last 20 years, 1987–2007, on milk yield, herd life and productive herd life of the breed in the farm were used for the study. Productive herd life was estimated as the difference between the date of first calving and date of disposal. Total herd life (longevity) was calculated as the average age at disposal. Effective production herd life was estimated by multiplying the number of calves born per cow by 365 days.

Data analysis

Collected data were entered into Microsoft Excel spreadsheet and summarized by descriptive statistics. Then GLM of SPSS (Version 11.5) was used to analyze the effects of different factors on the milk yield, herd life and productive herd life.

Models employed for the analysis were as follows:

Milk yield

1. LMY (Lactation Milk Yield) and LL (Lactation Length) (year and season of calving, parity, source of cattle)

$$Y_{jklq} = \mu + Cq + M_j + R_k + P_l + e_{jklq}$$

2. Lifetime MY (year and season of birth, source of cattle)

$$Y_{jkq} = \mu + Cq + M_j + R_k + e_{jkq}$$

where, Y = the observations on each trait;
μ = a value common to all animals (overall mean);
Cq = the effect of q^{th} source of cattle;
R_k = the effect of the k^{th} year;
M_j = the effect of the j^{th} season;
P_l = the effect of the l^{th} parity of dam;
e_{jklq}= the random error associated with $Y_{iklq}{}^{th}$ observations which is assumed to be normally and independently distributed with mean zero and variance σ^2.

RESULTS

Milk yield and lactation length

The overall means for milk yield and lactation length were 1691.59 kg and 318.42 days, respectively (Table 1). Year of calving ($p<0.001$) and cattle source ($p<0.05$) had significant effects on both traits. Parity ($p<0.001$) and cattle source ($p<0.05$) had significant effect ($p<0.001$) on lactation length. There were irregular trends of lactation yield and length throughout the years. The highest mean lactation yield and the longest lactation length were observed in 1994 (2126.97 kg) and 1998 (413.08 days), respectively. The least milk yield and the shortest lactation length were seen in 1991 (1327.75 kg) and 1988 (263.39 days). Of the total cows (696) studied 37%, 29.7%, 21.8%, 16% and 9.6% completed first, second, third, fourth and fifth lactations, respectively. On the other hand, lactation length declined towards fourth parity and then increased in the fifth parity. Lactation yield and length were higher for imported cows than those reared on farm. The overall mean of lifetime milk yield was 5565.19 kg (Table 1). From the factors considered in this study, only year of birth ($p<0.01$) had significant effect on lifetime milk yield. There was in general irregular trend of lifetime milk yield in the years included in the study. The highest lifetime milk yield was recorded in those cows born in 1991 (9014.76 kg) while the lowest was for those born in 2003 (2683.90 kg).

Table 1. Least squares mean (LSM) and standard errors (SE) for lactation milk yield (LMY), lifetime milk yield (LTMY) and lactation length (LL) of Jersey Cattle.

		Least Squares Means ± SE			Least Squares Means ± SE
Factors	N	LMY(kg)	LL(days)	N	LTMY(kg)
Overall	696	1691.59 ± 27.55	318.42± 3.92	232	5565.19± 220.03
Year of calving		***	***		**
1985	-	-	-	28	6352.53± 550.43^{b}
1986	-	-	-	32	5673.86± 521.08^{bc}
1987	18	1903.43± 104.29^{ab}	289.09± 14.85^{f}	10	6378.52± 1354.43^{b}
1988	30	1611.03± 85.02^{de}	263.39± 12.10^{fg}		-
1989	38	1486.47± 76.46^{g}	292.07± 10.88^{f}	13	5391.94± 792.27^{bc}
1990	32	1464.49± 76.32^{g}	277.12± 10.86^{f}	8	8065.38± 988.53^{a}
1991	18	1327.75± 94.25^{g}	306.68± 13.42^{cd}	8	9014.76± 990.38^{a}
1992	27	1632.97± 72.15^{de}	307.34±10.270^{cd}	10	5728.83± 879.40^{bc}
1993	23	1588.29± 83.39^{def}	280.45± 11.87^{e}	14	5995.30± 744.79^{bc}
1994	46	2126.97± 58.02^{a}	312.37± 8.26^{cd}	13	4624.11± 782.03^{bcd}
1995	53	1639.87± 60.02^{de}	327.45± 8.54^{cd}	10	6676.61± 890.69^{b}
1996	45	1723.45± 65.85^{d}	348.54± 9.37^{c}	12	4992.97± 806.01^{bcd}
1997	39	1823.60± 71.44^{abc}	360.94± 10.17^{b}	7	4903.09± 1056.86^{bcd}
1998	35	1819.98± 75.82^{abc}	413.08± 10.79^{a}	13	6293.06± 806.46^{b}
1999	22	1777.22± 99.48^{d}	366.83± 14.16^{b}	10	4994.00± 879.54^{bcd}
2000	38	1675.84± 68.48^{de}	365.75± 9.75^{b}	22	4578.13± 596.49^{bcd}
2001	39	1710.06± 71.28^{d}	301.36± 10.15^{cd}	11	4179.06± 840.82^{bcd}
2002	39	1535.05± 69.14^{def}	281.52± 9.84^{e}	6	2834.06± 1150.52^{e}
2003	49	1630.35± 62.97^{de}	305.36± 8.96^{cd}	5	2683.90± 1244.22^{e}
2004	30	1926.29± 76.87^{ab}	345.09± 10.94^{c}	-	-
2005	44	1769.87± 66.25^{d}	319.66± 9.43^{cd}	-	-
2006	30	1784.47± 149.44^{d}	313.33± 21.27^{cd}	-	-
Season of calving/birth		NS	NS		NS
Long rain	236	1692.59± 35.11	320.36± 4.99	64	5361.96± 436.639
Short rain	156	1695.44± 38.92	314.59± 5.54	64	5905.52± 361.74
Long dry	304	1686.73± 32.29	320.31± 4.59	103	5719.19± 303.78
Parity		NS	***	-	-
1	258	1656.92± 40.59	344.34± 5.78^{a}	-	-
2	207	1683.69± 38.29	330.48± 5.45^{a}	-	-
3	152	1741.01± 40.64	320.48± 5.78^{ab}	-	-
4	112	1682.34± 44.75	297.68± 6.37^{c}	-	-
5	67	1693.98± 54.95	299.12± 7.82^{c}	-	-
>5	37	1737.87±142.08			
Cattle sources		*	*		NS
Imported	66	1771.53±53.35^{a}	330.12± 7.59^{a}	60	5926.95± 408.62
Farm-bred	630	1611.65±35.79^{b}	306.72± 5.09^{b}	172	5397.49± 228.88

LSM with different letters within a factor differ significantly, *** ($p<0.001$), ** ($p<0.01$), *($p<0.05$), NS=non-significant, LMY=lactation milk yield, LL=lactation length, LTMY=lifetime milk yield.

Herd life and productive herd life

The overall mean for total herd life or longevity of Jersey cows was 2983.74 days (Table 2). Year of birth ($p<0.001$) and cattle source ($p<0.01$) had significant effect on herd life while season of birth did not. The maximum longevity recorded was 3642.95 days and the minimum was 2239.75 days. Higher herd life recorded for imported cows, 3294.25 days, than those raised on farm, 2834.91days. The overall means for productive herd life and effective productive herd life were 2310.11 days and 1663.15 days, respectively (Table 2). The average number of lactations in lifetime was 3.32. Cattle source had significant effect ($p<0.05$) on productive herd life while only year of birth affected effective productive herd life ($p<0.01$). Productive herd life was higher for imported cows, 2272.01 days, than those reared on farm, 1679.99 days. The longest effective productive herd life recorded was 2096.69 days, and the shortest effective productive herd life was 1228.52 days.

Table 2. Least squares mean (LSM) and standard errors (SE) of total herd life (THL) and effective productive herd life (EPHL) of Jersey cattle.

		LSM ± SE		LSM ± SE		LSM ± SE
Factors	N	THL (days)	N	PHL (days)	N	EPHL (days)
Overall	145	2983.74 ± 67.98	119	2310.11± 296.91	139	1663.15± 55.09
Year of birth		***		NS		**
1985	29	3159.72± 156.37^{a}	28	2163.94 ±178.01	25	1883.02± 104.16^{a}
1986	29	3421.17± 171.28^{a}	28	2357.32± 190.56	23	1789.15± 110.10^{ab}
1987	7	3642.95± 351.95^{a}	-	-	-	-
1989	8	3265.63± 189.11^{a}	-	-		
1990	9	3299.78± 199.45^{a}	9	2130.89± 218.79	8	1894.90± 175.87^{a}
1991	6	3290.33± 283.63^{a}	5	2226.20± 365.69	7	2096.69± 190.01^{a}
1992	8	2684.00± 172.48^{b}	6	1732.83± 183.34	8	1857.96± 174.53^{a}
1993	11	2608.63± 257.82^{b}	9	1967.78± 293.15	10	1765.18± 155.64^{ab}
1994	10	2285.30± 96.67^{cd}	5	1438.80± 179.88	7	1294.70± 190.30^{c}
1995	6	2715.83± 208.51^{b}	-	-		
1996	7	2434.86± 211.35^{cd}	7	1466.84± 126.23	6	1474.26± 202.10^{c}
1997	6	2347.67± 160.16^{cd}		-		
1998	4	2524.25± 27.25^{cd}	-	-		
1999	-	-	6	1065.13± 75.17	5	1228.52± 223.90^{c}
2000	4	2239.75± 83.03^{cd}	-	-		
Season of birth		NS		NS		NS
Long rain	43	2874.69± 137.12	29	2014.92± 162.04	38	1790.14± 90.89
Short rain	31	3010.00± 173.99	25	2279.04± 173.77	35	1787.36± 90.64
Long dry	71	2755.54± 109.41	65	1973.82± 105.62	66	1680.00± 66.42
Cattle source		**		*		NS
Imported	58	3294.25± 106.39^{a}	56	2272.01± 119.55^{a}	48	1825.02± 79.62
Farm-bred	87	2834.91± 90.03^{b}	63	1906.43± 116.33^{b}	91	1679.99± 57.08

LSM with different letters within a factor differ significantly *** ($p<0.001$), ** ($p<0.01$), *($p<0.05$), NS= not significant, THL=Total Herd Life, PHL= Productive Herd Life, EPHL= Effective Productive Herd Life.

DISCUSSION

The finding of milk yield in this study agree with EARO (2001) that reported 1619 kg/lactation length for Jersey breed cattle in Ethiopia. Nevertheless, Njubi *et al*. (1992) reported higher mean milk yield/lactation length in India, Tanzania, and Kenya, respectively. The result of the average milk yield/lactation length of this study is higher than that reported by Njubi *et al*. (1992). Year of calving has been shown to affect the lactation yield (Nega Tolla and Sendros Demeke, 2001; Mureja Shibru *et al*., 2002) in Holstein Friesian cows. Season of calving has no effect on milk yield (Rege and Mosi, 1989; Gupta *et al*., 1990; Njubi *et al*., 1992 and Mureja Shibru *et al*., 2002). The absence of seasonal influence on lactation yield and length in this study could be due to the fact that the animals managed on farm and lactating cows were given supplemental feed during the dry season. The finding that parity had significant influence on lactation length is in contrast with the report of Njubi *et al*. (1992). In this study, lactation yield increased with parity number up to third, which is in agreement with the reports by Mureja Shibru (2002), and Nega Tolla and Sendros Demeke (2001). This could probably be due to increment in body weight with maturity, and larger cows have more udder secretary tissue and larger digestive system.

The overall mean of lifetime milk yield in this study was lower than the finding of Narasimha and Mohan (1996) (7315 kg). Year of birth had significant effect while cattle source and season of birth did not as also observed by Gebeyehu Goshu (2005) on Fresian-Boran crossbred cows. The long calving interval found in this study could have contributed to the low lifetime lactation performance. The average length of herd life in the present study was by far higher than the reports of Njubi *et al*. (1992) and Narasimha and Mohan (1996). But Gebreegiziab-her Gebre-Yohannes and Mulugeta Kebede (2006) reported higher herd life for Boran and Horro crosses of Jersey. Studies in Brazil by Teodoro and Madalena (2005) showed a herd life of Jersey breed cattle which is closer to this finding. Year of birth has been shown to influence herd life (Melaku Negash, 2005).

The mean productive herd life found in the present study was much higher than the observation of Narasimha and Mohan (1996) and Njubi *et al*. (1992), which were 48.25 and 36 months respectively. The productive life for Jersey crosses with Boran, Horro and Sahiwal were 5.1 and 6.8 (Gebreegiziabher Gebre-Yohannes and Mulugeta Kebede, 2006) and 5.7 years (Singh *et al*., 1988) respectively. Only cattle source had significant effect on the productive herd life. Year of birth had significant effect on effective productive herd life. There was few previous works in Jersey cattle in this regard. However, there was a report indicating that year of birth had significant effect on productive herd life of Holstein cattle (Gebeyehu Goshu *et al*., 2007) and effective productive herd life of crosses of Friesian and Boran cattle (Gebeyehu Goshu, 2005). On the other hand, non-significant effect of year of birth on length of productive life was reported by Njubi *et al*. (1992).

CONCLUSIONS AND RECOMMENDATION

The lifetime milk yield found in this study was low. Inconsistency in management and variations in environmental conditions influenced the milk yield/lactation, lactation length, and lifetime milk yield. In addition, cows with high parity number tend to have lower milk yield. The herd life, productive herd life and effective productive herd life of Jersey cattle found in this study are in general satisfactory and not different from reports elsewhere. There is a big gap between total herd life and, productive and effective productive herd life indicating the presence of times wasted un-necessarily. In these cases extreme variability in management and environmental conditions through the years seem to affect the traits than any other factor considered.

To improve the productive efficiency of cows, there should be regular monitoring and evaluation of the productivity of cows in the herd and culling of cows with poor milk yield and unacceptable reproductive performance.

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