IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 09 Issue 08, August 2022
ISSN (Online) 2348 – 7968 | Impact Factor – 6.72
www.ijiset.com

Productive and Reproductive Traits of Butana Cattle under Atbara Livestock Research Station Condition

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Abstract

The study was conducted to investigate the performance of Butana cattle under Atbara livestock research station condition. The data used covered the first five lactations in 1079 records on 360 cows. The records were completed in the period from 1960-2008. The data was subjected to statistical program LS Mean and Harvy (1990). The overall least squares means of lactation milk yield and daily milk yield were 1348.94±174 kg and 5.08±0.45 kg respectively and highly significant (P≤0.01) affected by sires, parities and the linear regression on lactation length. The overall least squares means of lactation length and dry period were 264.91±6.17 days and 98.34±2.26 days significantly (P≤0.01), (P≤0.05) affected by parities respectively, the overall least squares means of age at first calving and calving interval were 47.06±2.71 months and 376.34±5.96 days respectively significantly (P≤0.01) affected by sires while calving interval also affected by year-seasons of birth.

Keywords: Butana- Native cattle- Sudan

Introduction

Butana cattle homeland is the Butana plain of central Sudan which is bordered by the River Nile on the west, Atbara River in the north and the Blue Nile on the south. It is a semiarid area with rainfall of about 300 mm between July and October. This Butana breed is also found along the River Nile in the Northern State. Rege (1999) reported that the Butana population was about one million heads. However, the population shows a decreasing trend due to extensive crossbreeding with Holstein Friesian which has picked up speed during the last 20 years. There is concern regarding the fate of this important genetic resource. Butana is important not only for crossing with *Bostaurus* but may also be required to upgrade or replace low producing cattle in harsh nomadic environments where exotic cattle cannot survive.

The breed is known as a good milk producer in a rather harsh environment and poor management. The Butana cattle are a deep red color and look very much like the Red Sindhi. It is probable that the ancestral stock of the Red Sindhi was a principal component of the Zebu cattle brought from medieval India to Sudan over a thousand years ago to form the basis of the Butana breed.

The objective of this study to characterize the production and reproduction performance of some traits of Butana cattle under Atbara livestock research station conditions.

Material and Methods

Historical Background, Origin of the herd and breeding policy:

Atbara livestock research station was established first at Shendi city 1943 and moved to Atbara in 1949 it was established as a military dairy farm to supply the soldiers with animal products (Ahmed, 1986). In 1974 the farm converted as research station, the objectives of the station were to produce milk and milk products and to improve through selective breeding the Butana cattle for dairy production (Mansour, 2000).The station situated north of Atbara in the River Nile State about 300 km north of Khartoum.

According to Mason and Maule (1960) Butana Cattle are a sub-type of northern Sudan short horned Zebu they are generally considered to have resulted from inter breeding Sanga cattle with short horn zebu during tribal migrations before recorded history. The foundation herd was bought from Shukria and Butana tribes after whom the breed was named.

Management and recording system:

The animals were housed in open sheds. Most of the cattle feed was given in the yard. The main part is fed as green Clover (*Medicagostavia)*and straw (*Sorghum vulgar stram*).

The concentrate ration is given during milking times the concentrate mixture is composed mainly of cotton seed cake, wheat brane, molasses mixture.

All cows are hand milked twice daily with the calf being present. The drying off of the lactating cows is carried out at two months before calving, the concentrate supplement is cut down and the dry cows are raised separately and fed straw in the yard the health of cattle on the farm is looked after by the technical department of the station. All cattle were sprayed regularly in order to control ticks and are vaccinated against Anthrax, Rinderpest and Contagious bovine Pleuro Pneumonia. Pregnancy diagnosis was made by rectal palpation two months after service.

In this station cows were not culled at a fixed age limit, but as long a cow did not fit itself to reproduce normally or showed low production or was unable to raise her calf, then it was

sold. Milk records are taken daily and summarized monthly and annually for each cow using kg as measurement.

Data collected:

Data on 360 cows were collected from Butana native cattle at different grade levels of production and productive traits.Dairy records up to the fifth calving of all cows were included in the study Covered 1079 lactation periods.

The experimental period was divided into three seasons of birth:

1. Summer from march through June (1).
2. Autumn from July through October (2).
3. Winter from November through February (3).

According to year of heifer birth, the herd was classified into six periods, each period extended for eight years covering the period of 1960-2008.

According to year season of birth the herd was classified into 18 groups covered the above mentioned period (1-18) (1960-2008).

According to parity number the herd was classified to five groups.

According to the sires used in the herd the herd was classified to 34 sires used in the breeding of this herd from (1960-2008).

These classifications were intended to reflect the environment in which the cows were producing and the genetic effect.

Data analysis:

Mixed model least-squares and maximum likelihood analysis (Harvey, 1990) procedures were used to adjust for the effect of sires, year seasons and parities.

The following models were fitted:

Model 1:

$$\mathbf{Y_{ijkm} = M+S_i+C_j+P_k+b_1A+b_2A^2+e_{likm}}$$

Where:

Y_{ijkm}= The ijkmth observation of the trait in question.

M= is overall least- squares mean.

S_i= Represent the effect of the ith sire of cow (i=1-34)

C_j= Represent the effect of the jth seasons of calving (j=1-3)

P_k= Represent the effect of the kth parity of cow (k=1-5)

A= Represent the deviation from mean lactation length.

b_1= Represent the linear regression coefficient of the trait.

b_2= Represent the quadratic regression coefficient of the trait.

$e_{ijkm=}$ Represent the random residual associated with the K^{th} observation.

The traits studied under this model were:

1. Milk yield per lactation (kg).
2. Daily milk yield (kg).

Model 2:

$$\mathbf{Y_{ijkm} = M+S_i+C_j+P_k+e_{ijkm}}$$

Where:

Y_{ijkm}= The ijkmth observation of the trait in question.

M= is overall least- squares mean.

S_i= Represent the effect of the ith sire of cow (i=1-34)

C_j= Effect of the jth seasons of birth of cow (j=3)

P_k= Represent the effect of the kth parity of cow (k=1-5)

$e_{ijkm=}$ Represent the random residual associated with the K^{th} observation.

The traits studied under this model were:

1. Age at first calving.
2. Calving interval.
3. Dry period.
4. Lactation length.

Results and Discussion

Generally, the reproductive performance and lactation performance of dairy cattle are closely associated with each other. The lactation performance of dairy cattle is usually measured by determining the total milk yield per lactation or per year, average daily milk yield, lactation length and lactation persistency. Milk yield production and farm income are determining the sustainability of a dairy farming operation.

Fertility traits have considerable economic significance through the normal flow of the production cycle (Lucy, 2001) and the reproduction traits show extensive variability under the influence of complex factors of the environment.

The productive life of a cow is an important economic source of income in most dairy enterprises. The analytical data results in Table (1) show that the effect of sires, parities and the linear regression on lactation length were a highly significant ($P<0.01$) on milk yield, this is coinciding with the finding of Musa *et al*., (2005) and the results reported by El-Habeeb (1991) for data on Butana cattle at the same station for sires effect. On the other hand year-seasons of calving did not have a significant effect on milk yield per lactation, this is

disagrees with finding of Alim (1962) when he studied the Butana cattle and reported that the variation between milk yield of cows calving in the different years were highly significant (P<0.01). In India Singh and Pandy (1970) studied the effect of season and year of calving on the economic traits of Haryane cows in Bihar; they reported that the season and year was significantly effective in introducing variation in milk yield. The overall least-squares mean of milk yield reported in this study was 1348.94±174.16 kg (Table 2) which is not in line with previous estimates by many researchers. Alim (1962) reported that the average milk production per lactation 3129.16 kg with standard deviation of 1709.16. Badri *et al*., (2011) reported that the overall means of total milk yield of Butana dairy cows at Atbara Research Station was 1709.50±892.10 kg. while Musa *et al*., (2005) analyzed data from the Butana herd of Atbara livestock Research Station and found a higher estimates might be due to the variation in management conditions at the station over the years. It is notable that milk yield in different calving year seasons varied from a high of 1662.44±253.83 kg to a low of 1146.95±238.15 kg. Also maximum milk yield was achieved in the fourth parity (1503±178.56 kg) and the minimum was in the first and second parities. (1205.13±179.43 and 1205.04±177.67 kg) respectively as shown in (Table 2).

Table 1. Analysis of variance: Effects of sires, seasons parities and lactation length on lactation milk yield[1]

Source	DF	MS
Sires	31	1524932.27**
Year-Season	17	217499.07NS
Parity	4	3717370.34**
Linear reg on LL	1	5359584.82**
Quad reg on LL	1	1820417.67*
Remainder	1023	381933.91

MS=Mean squares, DF= Degree of freedom

Table 2. Least squares means and standard errors of milk yield (kg) in different year seasons, parities and regression on lactation length[1]

Factor		No	LS Mean	Standard error
Overall mean		1079	**1348.94**	174.16
Year	Seasons			
1	1	89	1467.60	235.33
1	2	30	1662.44	253.83
1	3	66	1471.42	243.49
2	1	100	1405.35	210.34
2	2	93	1406.24	208.81
2	3	95	1492.18	208.43
3	1	102	1427.66	201.20
3	2	87	1413.56	202.37

3	3	104	1526.80	200.55
4	1	38	1319.74	211.64
4	2	31	1316.67	220.31
4	3	50	1335.69	206.21
5	1	51	1295.22	225.05
5	2	26	1239.27	241.56
5	3	28	**1146.95**	238.15
6	1	49	1348.65	259.44
6	2	19	1275.65	272.51
6	3	20	1226.29	273.92
Parity		No	LS Mean	Standard error
1		208	1205.13	179.43
2		260	1205.04	177.67
3		243	1345.66	177.81
4		203	1503.80	178.56
5		165	1485.06	179.56
Linear regression			1.2816	0.3421
Quad. regression			-0.0081	0.0037

[1] LS mean= Least squares mean

The results in (Table 3) shows the effects of sires, seasons, parities and lactation length in daily milk yield. The daily milk yield was highly significantly (P≤0.01) affected by sires, parities and linear regression on lactation length. But the season effect was not significantly effect this in coincide with Bashab (2021) for the same herd in Atbara Research Station when he reported that the season was not significantly affected the daily milk yield. The overall least squares mean of daily milk yield was 5.08±45 kg in different seasons. Less than that reported by Ageeb and Hiller (1991) when they studied Butana cattle at Atbara Station and stated 4.4 kg for daily milk yield. While Musa *et al*., (2005) reported 5.3 and 6.10 more than the results obtained in this study this differences might due to the management throughout the period of studies Table (4)

Table 3. Analysis of variance: The effects of sires, seasons parities and lactation length on daily milk yield

Source	**DF**	**MS**
Sires	31	244608.49**
Season	17	36586.62 NS
Parity	4	567057.12**
Linear reg on LL	1	7705380.80**
Quad reg on LL	1	347300.34*
Remainder	1023	69118.52

Table 4. Least squares means and standard errors of daily milk yield (gm) in different year seasons, parities and regression on lactation length

Factor		No	LS Mean	Standard error
Overall mean		1078	5.08	0.45
Year	Seasons			
1	1	89	5,55	0.79
1	2	30	6,36	0.89
1	3	66	5,58	0.84
2	1	100	5,09	0.66
2	2	93	5,27	0.65
2	3	95	5,44	0.65
3	1	102	5,23	0.61
3	2	87	5,24	0.62
3	3	104	5,45	0.61
4	1	38	4,85	0.68
4	2	31	4,73	0.73
4	3	50	4,83	0.65
5	1	51	4,76	0.78
5	2	26	4,77	0.87
5	3	28	3,89	0.85
6	1	6.18	5,05	0.97
6	2	19	4,89	0.103
6	3	20	4,52	0.104
Parity		No	LS Mean	Standard error
1		208	4.6	0.48
2		260	4,46	0.47
3		243	5.13	0.47
4		203	5.73	0.47
5		164	5.51	0.49
RGRS		Linear	-1.54	0.1456
RGRS		Quad	0.0035	0.0016

The analytical data results in (Table 5) Analysis of variance shows that the effect of sires and year seasons of calving on lactation length were not significant which is not in agreement with Elsamani (2000) who stated that season of calving had significant effect on lactation length and cows calving summer and autumn had longer lactation length than those calving in winter. While Osman (1972) revealed that both season of calving and lactation number did not significantly ($P>0.05$) affect lactation length, but year of calving significantly ($P>0.01$) affected it when he studied the Sudanese indigenous cattle. (Table 6) shows that the overall mean lactation length was 264.91±6.18 days less that reported by Musa *et al.*, (2005) who reported 256±32 days for Butana and Kenana cattle and was affected ($P<0.05$) by sire, year of calving and parity number.

Table 5. Analysis of variance: The effects of sires, seasons and parities on lactation length

Source	DF	MS
Sires	31	5132.94 ^{NS}
Year season	17	5077.51 ^{NS}
Parity	4	14546.76 **
Remainder	1025	4129.18

Table 6. Least squares means and standard errors of lactation length in different year seasons, and parities

Factor		No	LS Mean	Standard error
Overall mean		1078	264.91	6.18
Year	Season			
1	1	89	274.34	17.58
1	2	30	272.18	20.15
1	3	66	269.98	18.74
2	1	100	277.00	13.68
2	2	93	263.18	13.47
2	3	95	269.10	13.40
3	1	102	276.06	12.15
3	2	87	275.34	12.39
3	3	104	282.88	12.02
4	1	38	244.06	13.91
4	2	31	251.83	15.29
4	3	50	**287.69**	12.94
5	1	51	268.94	16.03
5	2	26	260.29	18.47
5	3	28	247.03	17.94
6	1	49	277.37	20.96
6	2	19	260.24	22.60
6	3	20	265.30	22.87
Parity		No	LS Mean	Standard error
1		208	265.27	7.60
2		260	260.01	7.17
3		243	274.92	7.20
4		203	254.08	7.44
5		165	270.27	7.69

Table (7) Analysis of variance showed that the effect of sires and year seasons of calving on dry period were not significant. While the effect of parities was significant. The overall mean dry period was 98.34±2.26 days which is higher than the general recommendation two months dry period, this result of dry period similar to that reported by many Sudanese researchers for the indigenous cattle exceeds the 60 days (between 119-159), Alim (1962),

Musa (2001) and Musa, *et al*., (2005) reported that the least square mean of dry period of Butana cattle was (119.10±8.30 days). Sharma *et al*., (1982) they stated that the dry period significantly affected by the season of calving (P<0.05) which is not in agree with the present result while Abdel-Aziz (1994) stated that the dry period was almost similar for cows calving during different seasons, which is similar to the obtained result apparently dry period is affected to a greater extent by managerial rather than genetic factors. Its longer dry period than the optimum period (60 days), this effect might be attributed to the changes in management policy related to feeding, drying off, and changes in climatic conditions and the environment factor over years Table (8).

Table 7. Analysis of variance: The effect of sires, seasons an parities on dry period (days)

Source	DF	MS
Sires	29	2185.26^{NS}
Year Season	17	2072.31^{NS}
Parity	4	6101.88*
Remainder	675	2104.39

Table 8. Least squares means and standard errors of dry period in different year seasons and parities

Factor		No.	LS Mean	Standard error
Overall mean		687	98.34	2.26
Year	Season			
1	1	41	**114.60**	17.03
1	2	14	113.24	19.46
1	3	37	108.86	17.15
2	1	75	96.72	10.93
2	2	65	99.63	10.66
2	3	56	95.69	11.15
3	1	60	99.10	9.64
3	2	55	100.56	9.75
3	3	61	109.93	9.62
4	1	29	128.35	11.13
4	2	19	100.20	12.85
4	3	32	108.81	11.03
5	1	29	88.95	15.09
5	2	17	92.54	16.28
5	3	26	82.62	14.31
6	1	35	68.96	18.17
6	2	22	68.21	18.19
6	3	14	93.06	19.70
Parity		No.	LS Mean	Standard error
1		154	98.24	4.21

2	149	92.31	4.17
3	152	89.91	3.98
4	150	103.41	4.03
5	82	107.84	5.57

First calving marks the beginning of cows productive life. Table (9) shows that the effect of sires on age at first calving was highly significant (P<.0.01), but the effect of year seasons were not significant this was disagree with finding of Elamin (1969) who found that the age at first calving was significantly (P<0.01) affected by the season of calving. In agreement with Bashab (2021) who showed that the season was highly significant effect (P>0.01) on age at first calving when he studied the same herd and the highest mean in summer while the lowest mean was in winter. The leaf squire mean of age at first calving in (Table 10) was (47.06±2.7) months higher than Alim (1962), Musa *et al*., (2005) and Ageeb and Hiller (1991); they stated (44 months), (45.05±3.56) and 3.2 years respectively. While Bashab (2021) reported mean age at first calving 53.109 months which is higher than present results this variation within this herd and between the others reflect the factors of environment and the genetic structure of the animals in the period of time and climatic change exactly in last year's.

Table 9. Analysis of variance: The effects of sires, years seasons of birth on age at first calving

Source	**DF**	**MS**
Sires	31	201.22**
Year-Seasons	17	46.26 ^{NS}
Remainder	343	56.70

Table10. Least- squares means and standard errors of age at first calving in different year seasons of birth of cow

Factor		**No**	**LS Mean**	**Standard error**
Overall mean		392	47.06	2.71
Year	Season			
1	1	3	40.16	6.47
1	2	1	53.66	8.44
1	3	8	44.61	4.79
2	1	17	46.04	4.05
2	2	13	45.11	4.05
2	3	34	46.81	3.76
3	1	68	43.96	3.46
3	2	29	44.20	3.65
3	3	41	46.17	3.52
4	1	32	49.97	3.66
4	2	28	48.65	3.73

4	3	30	48.62	3.52
5	1	14	46.10	3.93
5	2	9	49.58	4.16
5	3	12	43.95	4.13
6	1	29	50.20	4.18
6	2	9	48.95	4.48
6	3	15	50.31	3.96

The effect of sires, year season were highly significant while the effect of parities was not significant was shown in (Table 11).

The overall mean least square of calving interval was 376.34±5.96 day's as shown in (Table 12) close to Ageeb and Hiller (1991) and Musa (2005) and Bashab (2021) for same herd in Atbara Station in different periods of times.

Fengaly (1980) and Elhabeeb (1991) showed that the parity had highly significant influence on calving interval of Butana cows. The overall mean of calving interval in this study was close to the optimum calving interval 365 days this may be due to true expresser of genetic potential of the herd and applied management (Table 12).

Table 11. Analysis of variance: The effects of sires, years and seasons of birth on calving interval

Source	**DF**	**MS**
Sires	30	6122.00**
Year-Seasons	17	3813.89**
Parity	4	2549.95NS
Remainder	924	2045.78

Table 12. Least squares means and standard errors of calving interval (days) in different seasons, and parities

Factor		**No.**	**LS Mean**	**Error**
Overall mean		976	376.34	5.96
Year	Season			
1	1	64	363.55	15.06
1	2	27	361.56	16.39
1	3	56	357.38	15.32
2	1	104	359.46	10.62
2	2	83	360.30	10.60
2	3	91	348.38	10.58
3	1	88	362.69	9.74
3	2	76	373.89	9.88
3	3	96	382.29	9.63
4	1	41	378.05	10.72
4	2	30	384.09	11.72
4	3	44	386.72	10.60
5	1	35	367.93	13.63

5	2	21	392.56	15.46
5	3	32	380.56	13.85
6	1	45	403.65	16.37
6	2	22	402.53	17.11
6	3	21	408.49	17.55
Parity		No	LS Mean	Error
1		227	380.64	6.64
2		212	379.28	6.61
3		231	373.81	6.50
4		188	371.52	6.67
5		118	376.45	7.24

CONCLUSION AND RECOMMENDATIONS

Conclusion:

The overall least squares means of lactation milk yield and daily milk yield were highly significant (P≤0.01) affected by sires, parities and the liner regression on lactation length. The overall least mean square of lactation length (P≤0.01) (P≤0.05) affected by parities respectively. The overall of age at first calving and calving interval were significantly (P≤0.01) affected by sires and sires-and year seasons of birth respectively.

Recommendations:

Such conservation strategy can build on what is available at Atbara livestock Research Station.

The following steps can pave the way for the conservation and improvement strategy:

1. Increasing excellent cows from progressive breeders.
2. Improving the infrastructures of the station (irrigation facilities, milking machines, building … etc.)
3. Training of station staff in breeding and management.
4. More research in cladding more data is needed.
5. The importance of having records to be used for scientific research purposes.

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