

Effect of production systems on the performance of dairy cows in the Gezira State, Sudan

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ABSTRACT

This study was conducted in the Gezira State, Sudan, with the objectives of investigating and comparing the effect of production systems on age at first calving, calving interval, milk yield, herd structure, mortality and growth rate in traditional animal production and organized dairy farms. Six out of eight localities were included in the study. From each locality, 5 herds, each of traditional animal production and organized dairy farms were selected. This survey was carried out using questionnaire involving 40 farmers (including the surveyed farms) from each locality. Means and standard deviations for each studied parameter were calculated using SPSS. The result revealed greater differences in the studied parameters between the two systems of production. Feed had a great influence on animal performance. It could be recommended that, for improving the traditional farm performance, efforts should be paid to upgrade animal genetics through selection from highly producing local cows and introduction of foreign breeds. Feeding improvement in both terms of quality and quantity is also needed.

INTRODUCTION

Nutrition in general remains the most critical constraint to increase animal productivity. Generally, the quality of forage is often poor in arid and semiarid zones, as the plants are less digestible and the growth of forage is slow except during the rainy season (Payne and Wilson, 1999). On the other hand, reliance on sorghum crop residues may be one of the important reasons for reduced dairy production in traditional animal production. Sorghum stalks have low nutritive value because of their relative low digestibility, low crude protein and low content of available minerals and vitamins..

In the Sudan, livestock are specially essential, since they produce animal protein and wealth to the farmers. However, cattle are one of the most important livestock in the world due to their ability to produce milk, meat and draught power, (Payne and Wilson, 1999). The local breeds of cattle found in the Sudan belong to the group of north Sudan zebu (McDowell, 1972). As quoted from Sudanimal (2006), Kenana, Butana and Baggara are the most important breeds of north Sudan zebu. Most of these animals were reared under traditional system of production. Due to increased demand for milk and increased cost of keeping low producing animals, a number of dairy farms and upgrading of local animals with foreign blood gain much popularity especially in urban areas. The situation of livestock in Gezira State is much better than many other States, but still there are many constraints facing it. These constraints include nutrition, which represents the most important one in the State beside diseases, management and animal genetics. All these factors cause low productivity of local cattle breeds. However, milk production in Sudanese indigenous breeds Kenana and Butana (*B. indicus*) was found to be lower than that of Holstein Friesian cattle (*B. Taurus*) even under the same climatic conditions (Ageeb and Hayes, 2000).

There was no confirmed cattle population numbers since the official census of 1975 MARF (1975) and that carried out by DEVCO study in 1987 for animal integration in Gezira scheme . On the other hand, feed resource estimates were much controversial, but there was an agreement by many workers that feed is the main constraint facing cattle as well as other ruminant production.

Therefore, this study was designed to evaluate the performance of dairy cattle in both traditional herds and organized animal production farms in the Gezira State, Sudan.

MATERIALS AND METHODS

Location of Gezira State

This study was conducted in the Gezira state. which lies south east Khartoum State, between latitude 32 – 13° and 30 – 15° north and longitude 22 – 32° and 20 - 34° east. The total area is 27545 km² of which more than 80% can be utilized for agriculture. The state is divided into eight localities namely; Greater Wad Medani, Kamlin, Hassihessa, East Gezira, Umalgura, South Gezira, Managil and recently El Gurashi. Most of organized

farms are located in Greater Wad Medani, south Gezira and northern localities (Kamlin and Hasahiessa). The total population estimated at 4.4 million with a growth rate of 2.8%. In addition, animals are, estimated at 10 million heads (MALNR-Gezira State. 2015). Moreover, the state has good roads such as national tarmac roads, communication, irrigation from the Blue Nile and its branches beside reasonable rainfall, relative availability of energy and research institutions.

Animals

The study included only cattle as a source of animal protein. Common breeds are Kenana, Butana and crosses between Kenana by Friesian and Butana by Friesian. Due to some logistic difficulties, a survey to dairy farms and traditional herds included six out of the eight localities; interview with herders and dairy farm owners was carried out during the same time of survey. In each locality, five random organized dairy farms and five traditional herds were surveyed. Questionnaires were distributed to cow owners to gather information which consisted of number of animals, herd structure, herd characteristics, cattle breeds, characteristics of lactating cows and feeding systems.

Estimation of feeds

Quantity of crop residues was estimated on the basis of harvest index for sorghum wheat and groundnut according to the MALNR-Gezira state, Planning Department (2015), while cotton crop residues were estimated according to (El Obied, 2003). Feed energy and protein was calculated according to (Suleiman and Mabrouk, 1999).

According to MALNR (2015 pasture yield was estimated. Milk yield was estimated for both local and cross bred animal according to the average reported by herders and by attending milking for 5 days.

Statistical analysis

Data were analyzed using SPSS computer program.

RESULTS AND DISCUSSION

Animal performance

It is clear from Table 1 that, most of cattle population was concentrated in west Gezira State (Managil and Gourashi) Localities and East Gezira State (Um Algura and East Gezira Localities). However, the maximum animal density was in Al-Managil and the lower density was in Al-Kamlin Locality. Table 2 shows that the percent of mature cows was similar in both systems of production. However, the percent of lactating cows relative to mature cows was slightly higher in organized dairy farms (60% and 57%), respectively. The number of bulls, heifers and weaned male calves was higher in the traditional animal production farms, while number of weaned females and suckler was higher in organized dairy farms. Generally herd structure in this study (Table 2) was much different from that reported by Mohammed (2008), Animal composition of 75.6%, 11.3% and 13.1% of Kenana, Butana and cross bred, respectively, (Table 3) reported in this study was slightly different from that of 77.7%, 12.7% and 9.6% of Kenana, Butana and cross – bred respectively recorded by Mohamed (1994).

Table 1. Cattle population in different localities in Gezira state (in thousand).

Locality	Number of animals	Animal density/ km
Greater Wad Medani	30	50
South Gezira	177	52
Alkamlin	59	31
Um Algura	163	44
AL Hasahiesa	157	36
East Gezira	302	50
Al Managil	138	63
Al Gourashi	281	---
Total	1310	

Table 2. Herd structure percentages in traditional animal production and organized dairy farms in Gezira State.

Parameters	Traditional animal production farms	Organized dairy farms
Mature cows		40
Lactating cows	23	24
Heifers	15	11
Bulls		2
Weaned females	10	13
Weaned males	16	10
Suckler	14	25

Table 3. Cattle breed percentage in Gezira State.

Type of cow	Total in herd x (1000)	Percent of total
Kenana	394.62 ± 5.54	75.6 ± 1.4
Butane	59.21 ± 0.32	11.3 ± 0.6

Cross- bred	68.64 ± 0.55	13.1± 0.8
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Age at first calving

Age at first calving of 48.0 ± 3.0 months and 35.8 ± 2.8 months in the present study in traditional and organized dairy farm system respectively (Table 4) was in the range of 34.4 – 57 months and 44 – 50 months reported by Ageeb (2002) for Kenana and Butana, 45.05 ± 3.56 month for Butana recorded by Lutfi *et al.*, (2005) and 47.01 ± 12.91 for Kenana recorded by EL – Habeeb (1991) and of 42 – 48 for Kenana and Butana reported by Abdalla (2002). However age at first calving of 35.8 ± 2.8 month reported in this study for cross – bred animals (50% and 62.5% foreign blood) was lower than that of 40.5 ± 15.3 months reported by Ishag (2000) for 50% Kenana x Friesian crosses and also higher than that of 24 - 30 years reported by Abdalla (2002) for Friesian cows reared in the tropics. This may be attributed to increased rearing efforts and level of foreign blood. Generally, there was a general consensus in the surveyed area that, age at first calving is much shorter in crosses than in local breeds. However, the result of this study confirmed that consensus.

Table 4. Herd characteristics in traditional animal production farms and organized dairy farms in Gezira State.

Parameter	Traditional animal production farms	Organized dairy farms
Age at first calving (months)	48 ±3.0	35.8± 2.8
Calving interval(days)	537.5 ±73	401.5 ±67
Total mortality (%)	6.5	04.1
Withdrawals (%)	7.0	15.0
Growth rate (%)	1.5	04.9

Calving interval (CI)

A range of calving interval in local breeds was reported by many authors, for example a range of 363 – 433 days was reported by Payne (1970), 382.38 ± 8.3 days by Lutfi *et al.*, (2005) for Butana, 446.11 days by El Habeeb (1991) for Kenana, 513 and 618.9 days was reported by Musa *et al.*, (2006) for Kenana and Butana, respectively. The reported CI in this study (Table 3) of 536 ± 77 days for local breeds were within the range reported by Musa *et al.*, (2006). However, it is worth mentioning that, this year rainfall was low in the Gezira State. In organized dairy farms where most of the animals were cross – bred, CI was 401.5 ± 67 days (1.1 ± 0.17 year). This CI in organized dairy farms was almost similar to that of 421.6 ± 78.4 days recorded by Ishag (2000). However, it was lower than 429 ± 4 days in 50% Friesian and 432 ± 9 days in 62.5% Friesian blood reported by Syrstad (1990) for the tropics.

Herd growth rate (HGR)

As shown in Table 4, herd growth rate was much higher in organized dairy farms compared to traditional farms. As mentioned before, that this year was exceptional for the State specially for traditional animal producers. HGR of 1.5% in traditional system was much lower than that reported by MARF, (2005) and that of 2.6% calculated for seven-years form Mohammed

(2008), while HGR of 4.9% in this study in organized farms was much higher than the mean calculated from Mohammed (2008) and that reported by MARF (2005). This may be attributed to the shorter calving interval and lower herd mortality in organized farms compared to traditional herds.

Milk production

As shown in Table 5 milk yield per lactation was found to be 980 ± 72 and 2970 ± 213 liter in traditional and organized farms, respectively. This was due to the fact that, most of the lactating cows in organized dairy farms were from cross bred animals (Kenana x Friesian), while in traditional production, local breeds of lactating cows dominated. Also, feeding status was much better in terms of quality and quantity beside increased veterinary care in organized farms.

Generally, milk yield in local breeds in this study was much higher than that of 598 ± 98 and 538 ± 28 kg reported by Mohammed (2008) for Kenana and Butana respectively. However, the estimate of 1662 ± 59 kg for Butana in Atbara Research Station and 1433.35 ± 71 kg per lactation in Um Benin Livestock Research Station for Kenana reported by Musa *et al.*, (2006) was much higher compared to that of the present study for local breeds. This may be attributed to that, animals in research stations resulted from continuous selection through long generations. However, cross bred cows in this study produced more milk per lactation compared to that of 2417.2 ± 921 kg for 50% Kenana x Friesian cows reported by Ishag (2000) and that of 1984 ± 75 in 50% *Bos taurus* and 2039 ± 28 in 62.5% *Bos taurus* reported by Syrstad (1990). Also Ageeb and Hayes (2000) reported 5119 ± 173 kg for Friesian in the Sudan and 4981 ± 81 kg in lactation adjusted to 305 days. Both authors reports were much higher than that for cross – bred animals in this study. This may be due to that yield reported by the authors was for pure animals.

Table 5. Characteristics of lactating dairy cows in the Gezira State

Parameters	Traditional animal production	Organized dairy
Percent lactating cows in the herd	57	60
Lactation length (days)	270 ± 35	270 ± 11
Average milk yield (kg)	980 ± 72	2970 ± 213
Average number of lactation	5	9

Animal feeds

Table 6 shows that, in the traditional animal production, crop residues (mainly sorghum straw) represented 60%. Crop residues was calculated from Ali (2005), showed that crop residues represented 75.6% of total food input. On the other hand, the main feed in organized dairy farms (Table 6) was green fodder, which contributed 50% of the total food. In traditional animal production green fodder represented only $13.3 \pm 0.7\%$ of total feed (Table 6). This was higher than 8.9% calculated from Ali (2005). As shown in Table 7, crop residues contributed around 50% and more than 40% of total feed energy and protein, respectively, in traditional production farms. However, these feeds are bulky, result in reduced intake, and

hence energy and protein. In organized farms, crop residues contributed about 11% and 9% of feed energy and protein respectively. Moreover, in organized farms concentrate contributed 40% and 50% of feed energy and protein, respectively, while green fodder about 50% and 40% of energy and protein, respectively. In addition, as presented in Table 8, energy and protein concentration in organized farms were much higher than in traditional farms. Generally, cereal crop residues are low in nutritive value because of their relatively low digestibility, low crude protein and low content of available minerals and vitamins and reduced availability of amino acids (Cheeke, 2005) .

Table 6. Ration composition in the Gezira State.

Feed	Percent composition	
	Traditional	Organized farms
Green fodder	13.3 ± 0.7	52 ± 3.1
Natural pasture	21.0 ± 1.4	00
Agricultural crop residues	60 ± 5.1	18 ± 1.6
Concentrates	5.7 ± 0.31	30 ± 1.3

Table 7. Contribution of different feeds in energy and protein.

Feed	Traditional animal		Organized dairy	
	Energy	Protein (%)	Energy (%)	Protein
Green fodder	16.2	16.2	47.7	40.4
Natural pasture	25.0	25.0	-	-
Crop residues	48.5	44.1	11.4	8.6
Concentrates	10.3	14.7	40.9	51.4

Table 8. Total feed energy(MJ /kg) DM and protein (g/kg DM).

Feed	Traditional animal production		Organized dairy farms	
	Energy (%)	Protein (%)	Energy (%)	Protein (%)
Green fodder	1.1	11.0	4.2	42
Natural pasture	1.7	17.0	0.00	00
Crop residues	3.3	30.0	1.0	09
Concentrates	0.7	10.0	3.6	54
Total	6.8	68	8.8	105

RECOMMENADATION

Difference in production systems between traditional and organized dairy farms were reflected on animal performance and herd characteristics. Therefore, to improve the traditional farm performance, efforts are needed to upgrade animal genetics through selection from highly producing local cows and introduction of foreign breeds. Feeding improvement in both terms of quality and quantity is also needed.

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أثر نظم الانتاج المختلفة علي اداء الابقار بولاية الجزيرة , السودان

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الخلاصة

اجريت هذه الدراسة بولاية الجزيرة بغرض التعرف ومقارنة أثر نظم الانتاج المختلفة علي العمر عند اول ولادة والفترة بين الولدتين و انتاج اللبن وتركيب القطيع والنفوق ومعدل النمو في كل من قطاع الانتاج الحيواني التقليدي ومزارع الالبان المنتظمة . شملت الدراسة ستة من ثمانية محليات. اختير من كل محلية 5 قطعان من كل من قطاع الانتاج الحيواني التقليدي ومزارع الالبان المنتظمة. دعم المسح باستبيان شمل 40 مزارع من كل محلية. حسبت المتوسطات والانحرافات المعيارية لكل عنصر من عناصر الدراسة وذلك باستخدام نظام الحزم الاحصائية للعلوم الاجتماعية (SPSS) كشفت الدراسة عن فروقات معنوية بين العناصر المدروسة في كل من النظاميين واكدت ان الغذاء له اثر كبير علي اداء الحيوان وكذلك العناصر الأخرى خاصة الوراثة قد يكون لها اثر علي الاداء. من اجل تحسين مزارع الانتاج الحيواني التقليدي توصي الدراسة تبذل مجهودات لرفع الكفاءة الوراثة للحيوان من خلال الاختيار من الابقار المحلية العالية الانتاج وادخال السلالات الاجنبية . أيضاً يجب رفع مستوي الغذاء من الناحية الكمية والتنوعية.