Research Journal of Animal Sciences 1 (1): 20-23, 2007

Comparative Assessment of Draught Performance of the One Humped Camel (*Camelus dromedarius*) and *Bunaji* Work Bulls in Zaria, Nigeria

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Abstract: The study was carried out to evaluate the draught performance of the dromedary and *Bunaji* work bulls as draught animals for ridging, ploughing and weeding operations in a sub-humid environment of Nigeria. Four work dromedaries singly harnessed and 8 *Bunaji* work bulls yoked in pairs were used for the evaluation. The camels' mean weight was 450±12.8 kg while a pair of bulls weighed 760±15.4 kg. The animals were made to plough, ridge and weed an area of 1500 m^2 of uncultivated flat land. The absolute draught force produced by one dromedary for ridging (0.80 kN), weeding (0.36 kN) and ploughing (0.18 kN) were not significantly different ($p>0.05$) from that produced by a pair of work bulls (0.79 kN, 0.30 kN, 0.30 kN) for same operations although the live weight of a pair of work bulls (760±15.4 kg) was significantly ($p<0.01$) higher than that of a single dromedary (450±12.8 kg). The bulls ridged 0.23 ha of land per hour (1 ha / 4.4 h) which was significantly ($p<0.01$) faster than the camels' 0.18 ha per hour (1 ha 5.3 h^{-1}). It is thus conclusive from this study that, the one humped camel can be efficiently utilized as an alternative draught ruminant in the sub-humid savanna zone of Nigeria.

Key words: Draught performance, camelus dromedarius, *Bunaji* work bulls, Nigeria

INTRODUCTION

The use of animals as a source of farm power is advantageous due to its low cost, its timely availability and its capacity to increase cultivation areas (Gefu *et al*., 1990; Oladele, 2003). In Nigeria, tractor ownership or hire is beyond the reach of the vast majority of small-scale farmers who produce the bulk of the staple food consumed in the country (Sanni *et al*., 2004). Most farmers also, do not possess the capacity to keep pace with the increasing technical sophistication of the imported agricultural machinery where available (Auduson, 1990; Oladele, 2003). The need to achieve timeliness in land preparation led farmers to explore the readily available animal power alternative to the family based manual labour (Phillip and Ogungbile, 1990). Draught animals provide farm power that derives its energy sources from local materials and equipment that can be made by a local blacksmith. Therefore scarce foreign exchange is not needed for either input (Pearson *et al*., 1996).

The dromedaries have been used as pack and riding animals only (Raghvendar *et al*., 1998) but their potentials as research animals for cultivation is been recognized (Harvey, 1984; Bhakat *et al*., 2004). The dromedary was reported to be more draught efficient and fatigue tolerant than the oxen (Rai *et al*., 1991; Rai and Raghvendar, 1994; Bhakat *et al*., 2002).

The use of dromedaries for land cultivation is relatively new among the farmers in northern Nigeria therefore little information is currently available in terms of their draught performance and physiological response to research (Hassan, 1995; Tukur and Maigandi, 1999; Mohammed, 2000).

This study was therefore designed to determine and compare the draught performance of the dromedary with that of *bunaji* work bulls, the most predominantly used draught ruminant in Zaria, a sub-humid environment of Nigeria. This information is necessary in order to sensitize farmers on the practicability of utilizing camels as alternative draught ruminants in the zone.

MATERIALS AND METHODS

This study was carried out at the National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria, Nigeria located on latitude 11°12'N, longitude 7°33'E and on altitude of 610 m above sea level. Shika is within the Northern Guinea Savanna zone and has a sub-humid tropical climate. Four clinically healthy male camels

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Table1: Mean values of ridging, pl+oughing and weeding for dromedary and bunaji work bulls in Shika-Zaria, Nigeria

Parameters	Ridging		Ploughing		Weeding	
Animal specie	WD	WB	WD	WB	WD	WB
Live weight (kg)	400±62a	760±15b	400±62a	760±15b	400±62a	760±15b
Draught force (kN)	0.80a	0.79a	0.18a	0.30b	0.36a	0.29a
Work output (kW)	0.74a	0.99b	0.25a	0.31a	0.48a	0.28b
Working speed (m sec^{-1})	0.93a	1.25a	1.36a	1.06a	1.34a	0.97a
Depth of ridging (cm)	12.5a	11.8a	11.9a	10.5a	3.1a	3.5a
Area ridged / hour (ha)	0.18a	0.23b				
Soil moisture %	9.43	9.43	5.89	5.89	5.42	5.42

Means with the same letters in a row were not significantly different ($p<0.05$), Key: WD = Work Dromedary, WB = Work Bulls

aged between 5 and 7 years and 4 pairs of trained *Bunaji* work bulls also aged between 5 and 7 years were used for the study.

Draught force trials: The dromedaries were singly harnessed, as has been the practice among farmers using camels for work in northern Nigeria, while the bulls were yoked in pairs. The animal drawn tillage implements used were Emcort® Ridger (42.0 kg); Kasco® weeder (28.2 kg) and Kasco® plough (24.0 kg) Chain (3.0 kg). The animals were handled and controlled by their attendants.

The length of ridges per field prepared were measured using a metre rule tape, while an electronic dynamometer, calibrated in Kg force, was used to measure the actual draught force during the experiments The working speed was measured as the time it took the animal to complete a ridge of a given length with a stopwatch. The experiment was repeated with the same set of animals for ploughing, ridging and weeding operations. The average draught force was used in the computation of the draught power. The actual draught force is defined in this study as the force with which the animals pulled an implement while draught power is the rate at which work is performed. According to Matthews (1987) the computation of power output is done on the basis of the relationship between the draught force and the working speed as stated below:

P = Force X Velocity
Where P = Power output (kW)
Force = Recorded draught force (kN)
Velocity = Working speed (m sec^{-1})

The live weight measurements of the animals was determined using the *Avery*$^{(R)}$ cattle weighing scale

Statistical analysis: Data were analyzed by use of SAS (1989) software and Duncan's Multiple Range Test (Duncan, 1955).

RESULTS

The results of this study are presented in Table 1. The camels' mean weight during the period of the study was 400±62.01 kg while that of a pair of bulls was 760±15 kg. The camels ridging speed was 0.93±0.09, weeding 1.34±0.11 and ploughing 1.36±0.11 m s^{-1} while the average ridging depth was 12.53±2.3 mm, the bulls on the other hand had the following speed: ridging 1.25±1.10, weeding 0.97±0.15, Ploughing 1.06±0.13 m s^{-1} and ridging depth of 11.8±2.8 mm .

Results of the study showed that absolute draught force produced by 1 dromedary for ridging was 0.80 kN, weeding 0.36 kN and ploughing 0.18 kN; the bulls produced 0.79 kN for ridging, 0.29 kN for weeding and 0.30 kN for ploughing. The draught power exerted was: Camel 0.74 kW ridging, 0.48 kW weeding, 0.25 kW ploughing, Bull: 0.99 kW ridging, 0.28 kW weeding and 0.31 kW for ploughing. The bulls ridged 0.23 ha of uncultivated land per hour (1 ha 4.4^{-1} h) which was significantly ($p<0.01$) faster than the camels' 0.18 ha per hour (1 ha 5.3 h^{-1}).

DISCUSSION

The research performance of 2 species of animals being compared was assessed on the basis of draught force and power output. The non-significant effect of animal species on the actual draught force exerted indicates that the performance of a pair of bunaji work bulls was similar to that of a single dromedary for ridging, ploughing and weeding operations. This implies that a single dromedary can substitute a pair of work bulls under similar conditions and confirms an observation that a camel of 600 kg can effectively replace an 800 kg work bull pair for tillage operations in sandy soils (Pathak, 1982).

Both the work bulls and the dromedaries exerted more draught force during ridging operation than during ploughing and weeding operations probably because of the demand for deeper cultivation and also because the ridging operation is carried out at the onset of cropping season when the rainfall is not well established and the soil is relatively hard compared to the time of weeding (Mohammed, 2000). The ploughing operation uses only one blade plough, therefore exerting little friction while the depth of cultivation required for weeding is generally shallower than the depth required during ploughing or ridging.

Draught power output of 0.77 kW exerted by single harnessed dromedaries in Sokoto, Nigeria (Mohammed, 2000), 1.34 kW in Niger Republic (Slingerland, 1989) and 0.82 kW or 1.10 hp exerted by single harnessed Indian camels (Aminudeen *et al*., 1998) are all comparable and in agreement with results of this study (0.74 kW or 0.99 hp). The ridged area per hour by the Indian camels (0.74 ha h^{-1}) is by far greater than what was obtained in this study (0.18 ha h^{-1}). This difference could be attributed to both farmer and animal experience and to the soil type (Mohammed, 2000).

The comparable draught performance of a single dromedary to a pair of bunaji work bulls obtained in this study could be due to better coordination, which was apparent in a single animal than when the animals are in pairs and also to the camel's large body size and disposition. This is in agreement with Bartholomew *et al*. (1994) that power output, which is a measure of work output, was primarily dependent on body size. This therefore, leads to the recommendation that farmers be encouraged to use large framed animals, since such animals are likely to work better even under seasonal fluctuations in live weight (Bartholomew *et al*., 1994).

Starkey (1989) had highlighted the advantages of using a single harnessed draught animal; that a single working animal will not normally require as much feed as 2 animals and that the marginal amount of research can compensate for the extra energy that the animal would require to achieve the efficiency of a pair as obtained in this study.

CONCLUSION

It is concluded from this study that, the 1 humped camel can be effectively and efficiently utilized as an alternative draught ruminant in the sub-humid savanna particularly in areas where animal feed is an important livestock management cost factor.

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