(b) India

Management and bioenergy use of the indian dromedary camel

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Introduction

The Indian camel (*Camelus dromedarius*) was domesticated more recently than other draught animals. The camel population of the world is 19.32 million and in India, 1.03 million camels (FAO, 2002). The methods of camel keeping are now changing worldwide because grazing land is decreasing. Camels which are largely maintained under extensive system are now facing problem and their management needs a better alternate system, which is socially acceptable and economically viable for effective use of its bio-energy.

Camel management

Camel management by Raikas

In India large camel herds are owned by the Raika/Rabri community. Other group's viz. Jat, Rajput, Muslim own a small number of camels. Many of the migratory camel herd return at regular interval to villages for water, but they can also come several hundred km from their owners home. The Raikas are able to keep track of their movements because they can identify the footprints of each of their camels.

Camel management by extensive system

Camels are allowed to graze freely and reproduce freely. All the camels are collected usually in the spring season for hair shearing, treatment against mange, branding etc. The animals are released for free grazing again after the above operations. It is usually necessary to collect the camel herds during the 3 months of the rainy season (July to September) to prevent them from damaging crops. Most, but not all herders also like

to supervise their camels during the breeding season, which traditionally falls between November and March.

Camel management by semi-extensive system

Camels are maintained around cities and villages in the marginal area. During severe drought period camels have been fed in special feed lots for 2–4 months, by keeping at shelter. During this period daily body weight gains are expected to be more.

Shelter management

Research trials were conducted on three types of shelters for camels which have been developed under the world bank funded research project at NRCC, Bikaner, India (Bhakat *et al.*, 2004).

1. **Thatched roofed open type Kuchchha shelter:** It was constructed using locally available eco-friendly agricultural materials. It has a covered and an open area (Plate 11). The roof is made of Khemp (*Leptadenai Pyrotechnica*). One side of the roof is supported by a wall and the other side by pillars (14"). The Kuchchha manger is constructed with mud plastering inside the covered area. The enclosure is made from balli / bamboo of 6 ft height. The front side of the enclosure has a sliding type gate. The height of the shelter roof is 15 ft (back) and 12 ft (front) with slope. The covered area is 33 x 14 ft. The floor is covered

Plate 11: Thatched roofed open type Kuchchha shelter for camels (C. Bhakat)

- with sand. The total area space of this shelter is 40 x 33ft. It is an open type shelter. The dimensions of the manger are: Length 32 ft, breadth 2.5 ft, inside depth 1.5 ft, height of front wall from ground 3.5 ft.
2. **Asbestos roof close type concrete shelter:** This also has a covered and open area. The covered area is covered by an asbestos roof with concrete walls on 3 sides. The floor is loose sand. The manger is of concrete / pucca type. The open area is enclosed with balli/ bamboo with a sliding type gate at the front. The total area space (covered and open), height of roof, dimension of manger and enclosure are almost similar to the thatched roofed open type kuchchha shelter.
3. **Under tree shed / loose housing system:** An open type paddock is provided, enclosed by wire fencing. The fence is supported by iron angle. Some Kikar trees (*Prosopis Juliflora*) are there to provide shade for the camels. The floor is covered with loose sand. A Kuchchha manger was constructed with mud plastering just beneath the tree shade. The manger is of round type. The

dimension of manger, height of fence etc are almost equal to other two types of shelter.

Feeding management

In stall-feeding conditions the average feed consumption is greatest during the first 2 hrs and decreases subsequently. Table 15 represents the feeding schedule followed at an organised farm at NRCC, Bikaner, India.

Table 15: Feeding schedule followed at an organised farm (NRCC, Bikaner)

Age of camel (months)	Fodder and concentrate
Up to 12 month of Age	2.5 Kg fodder + 0.5 Kg concentrate mixture
1-2 Year	5 kg fodder + 1 kg concentrate mixture + 30 gm salt
2-3 Year	8 kg fodder + 1.5 kg concentrate mixture + 90 gm salt
Above 3 Year	12 kg fodder + 2.5 kg concentrate mixture
Studs	14 kg fodder + 3 kg concentrate mixture

In semi intensive conditions camels are provided with dry fodder viz. moth (*Phaseolus aconitifolius*), guar (*Cyamopsis tetragonoloba*), mumphali chara (*Arachis hypogea*). Concentrates are mostly molasses, oil (from groundnut or sesame), and ghee (butter oil processed from milk) and sometimes cereals, pulses, alum (hydrated aluminium potassium sulphate).

Health management

There is a large body of ethno-veterinary knowledge on the camel, derived from generations of interaction and interdependence with these animals. Even, today camel keepers rarely have access to modern veterinary medicine. They continue to rely on their own system of disease prophylaxis, diagnosis and treatment.

Camel farmers have long recognised the effectiveness of many plant substances in treatment of diseases. These include several herbs, shrubs, roots, seeds etc. which are commonly used in Indian medicine for human. They have identified plants which detoxify the venomous action of biting insects and animals like scorpions, snakes and flying insects. Some plants which have hormone like activities are used for lacto-stimulation or anthelmintic properties. Farmers recognise vegetation and plant products for their antibacterial and antifungal characteristics in treatment of infections, fungal skin diseases, oral diseases etc. In addition, camel keepers have detailed knowledge of poisonous plants and their antidotes, which include drenching of infusions of plant preparations and solution of salts. The ethno-veterinary medicines are low cost, adaptive and accessible to the camel keepers.

In an organized farm (NRCC, Bikaner), the camels are provided both prophylactic and curative measure to control ecto-parasite and internal parasites. The calves and pregnant females are given vitamins-A. A course of antibiotics is given to check diarrhoea.

Bio-energy use

Carting

A comparative study of camel and bullock carting systems (Bhakat *et al.*, 2002) revealed that pay back period is almost double in bullock carting as compared to camel carting, whereas the benefit cost ratio is $\frac{3}{4}$ higher in camel carting. Because of these characteristics camel carting is more profitable than bullock carting for small dryland

farmers in the hot arid Thar desert. Rai and Raghvendar (1994) studied Indian camels carting 1.5 to 2 tons. Over 4–6 hours they covered a distance of 30–40 km with the load on a two- or four-wheel cart without showing signs of distress. A camel can work for 4 hr at a stretch and 6 hr with 2 hr rest in between. The speed, draught force, work performance and power output declines with the increase in distance covered. The draught force generated by a dromedary camel ranges from 90–125 kg amounting to 17–22% of body weight. The tractive force (N) and work done (kJ/kg) at 2.8 kg/kg body weight pay load up to a distance of 22 km was 586 to 791 and 1.54 to 1.70 respectively. The horse power (hp) generated was 0.93 to 1.27hp. On the basis of blood physiological and biochemical fatigue indicators, it was observed that a four wheel cart is better than a two wheel cart. The Bikaneri breed of dromedary camels is better than the Jaisalmeri or Kachchhi breeds for endurance in draught, whereas the Jaisalmeri breed performs better for riding/race. Heart girth, height at wither and body weight and length of camel are positively correlated with horse power and draught. The work-rest cycle indicated 2 hour rest to be sufficient after 4–5 hours continuous work.

Riding

The characteristics of a good riding camel are long legs, display boldness, alert expression, symmetrical hump, broad muscular full thighs, small-sized foot-pads and strong knees joints. The slender riding camel can cover up to 100 km/day at an average speed of 15–20 km/hr over long period and a stocky pack dromedary can cover 20–25 km/day at an average speed of about 5 km/hr and can carry burden of 200 kg on its back (Burgemeister, 1978). Khanna *et al.* (1996) reported camels travelled 950 km in 29 days and covered from 24 to 70 km/day at an average of 43.2 km/day in a camel safari across the desert of Rajasthan, India. Raghvendar *et al.* (1998) found that riding Indian dromedary camels completed 15 km at a stretch at speed of 8–9 km/hr. The level of lactate and cortisol in the riding camels indicated better riding endurance in female than male Indian dromedary camels.

Racing

Camel racing in the Gulf and certain Arabian countries is an important cultural event which emphasises the Bedouin traditions. The long limb length enables the pacing gait to be maintained even at high speeds. This gait would therefore appear to allow greater mechanical efficiency and therefore speeds around 9–10 m/sec to be maintained despite relatively low oxygen availability. Raghvendar and Sahani (2000) reported better race potential in the Jaisalmeri than Bikaneri breed of Indian female dromedary camels. Average race speed (km/hr) for 1, 2 and 3 km distances ranged from 29 ± 2.6 to 37 ± 3.2 and 25 ± 3.2 to 30 ± 1.8 for the female of the Jaisalmeri and Bikaneri breed, respectively. The maximum race speed of female and male Jaisalmeri and Bikaneri camels during a 3 km race was 29.4, 28.4, 24.4 and 27.9 km/hr, respectively. Evans and Rose (1988) reported that with maximal heart rates (HR max), the maximum stroke volume in the camel which is a slightly lower maximum stroke volume than found in horses. The oxygen cost of transport per km travelled is 50% of the cost compared to the horse.

Ploughing

Rai *et al.* (1991) found that camels could plough continuously for 4.25 ± 0.27 hr and covered an area of 3136 ± 168 Sq metre. The draught produced was 14% of body

Plate 12: Ploughing with a camel in Rajasthan, India (C. Bhakat)

weight, the horse power generated was 1.1 and the average ploughing capacity per 100 kg body weight was 523 ± 0.37 Sq metre. The camel is capable of ploughing at approx 2.5 km/hr but it is recommended not to work a camel for longer than 6 hours at stretch. Camels can produce up to 1 hp energy during ploughing covering 1 ha in 11 hours and could plough 500 kg sq.metre/hour at a depth of 16" (Plate 12).

Defence

Presently the camel corps contributes an important wing of the border security force of the Indian Para military services and is used for patrolling in the desert belt of the border. The role of camels in defence is very well evidenced from ancient times and during the First and Second World War by camel battalions in arid region. The camels formed an important component of the army during the Maurya period (AC 322–232 BC), which continued through middle ages (Mughal period 1200–1700 AD) to the present times. The famous Ganga-Risala of the erstwhile Bikaner State was accepted in the Imperial service troop and participated in World War I and II. In independent India, the Ganga Jaisalmer Risala was constituted in 1948.

The rapid change in agro-ecological conditions and industrialisation in recent years has had an impact on camel management systems and bioenergy use. It is essential in future to adopt scientific management practices to achieve efficient use of camel resources round the year for different purposes.

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SHORT NOTES AND NEWS

■ **The Reach**

This is a directory of suppliers for people using horses for driving and work. There is a good article by Lyn Miller in the 2004 Directory 'Work versus show and the future of the draught horse'. The directory costs US\$7.00. Contact: The Reach, PO Box 932, Kendallville, Illinois 46744 (Tel: 1 206 347 8223, Fax: 1 260 347 9255, email: kcp@mchsi.com).

■ **Websites**

<http://www.act.org.zw> for the African Conservation Tillage Network who welcome contributions to their newsletter.

<http://www.bourricot.com> for a French website providing information for donkey owners.

<http://www.traitsdegenie.com> for a website on draught horses, donkeys and mules in Europe.

<http://www.equinfo.org/interagri> for a website providing information on nutrition of horses mainly in temperate areas.

<http://community.webshots.com/user/whitelodge100> for some pictures of Robert Johnson's draught work in Australia in 2003/2004.

<http://www.bajutsu.com> for advanced notice of equine events in France involving working animals as well as ridden ones.

<http://www.gtkp.org> is the website for the Transport Knowledge Partnership which contains a useful database concerned with transport issues and organisations.

■ **Animal Traction Email Discussion Group**

A reminder to people who may not know of the existence of this discussion group and how to join it from **Paul Starkey** P.H.Starkey@reading.ac.uk.

This mailing list is intended for the discussion in the field of animal traction theory and practice without any restriction on the system used. Typically the material will be question-and-answer on actual problems but any contributions are welcome. Share your knowledge or ask questions about:

(a) research projects and results	(c) new technologies and products
(b) valuable experiences	(d) any topics related to animal traction