CAMEL BIOENERGY FOR INDIAN RURAL DRY LANDS

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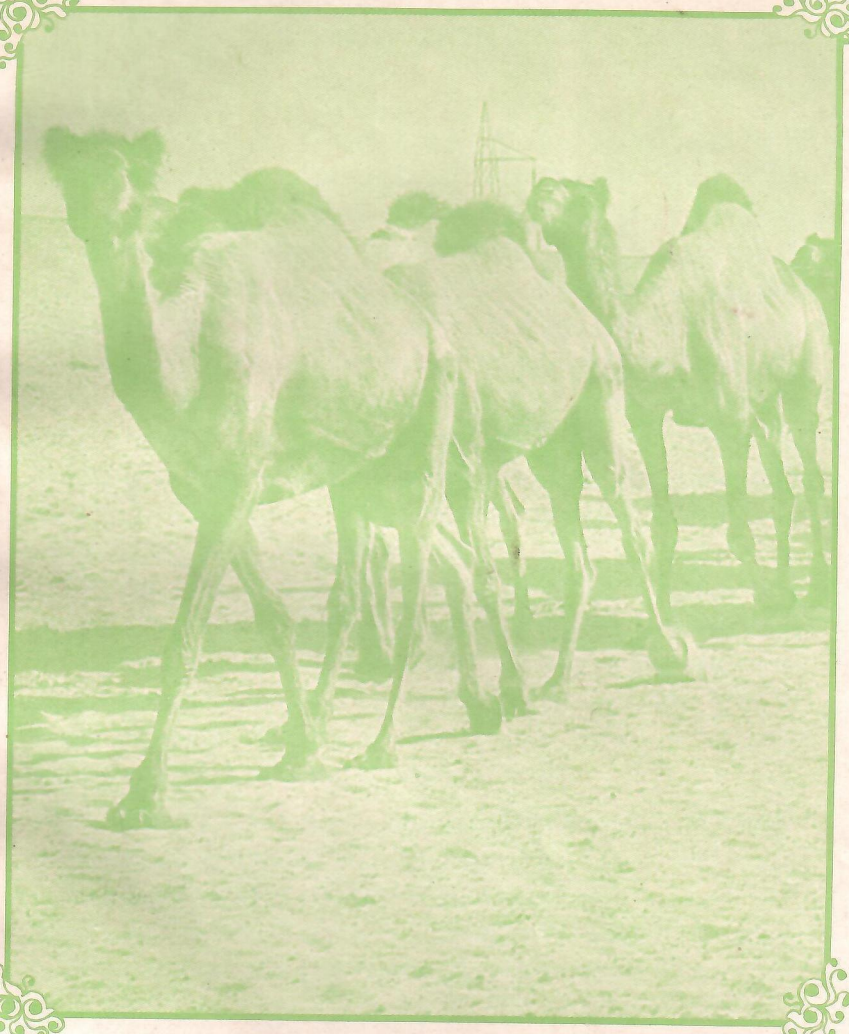

NATIONAL RESEARCH CENTRE ON CAMEL
BIKANER

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CAMEL BIOENERGY FOR INDIAN RURAL DRY LANDS

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The Camel *(Camelus dromedarius)* is an important livestock of the dry lands. Sustainable camel production in the dry land ecosystem has been emphasised. Out of 19.45 m world camel population, India has estimated 1.45 m, which is ranked third highest after Somalia and Sudan. As per distribution of world camel population, Africa has 74.6%, Asia 23.9% and remaining 1.5% in rest of the world. In India, the States of Rajasthan, Haryana and Gujarat have 88.2% of total Indian camel population consisting of 70.1, 11.2 and 6.9% respectively. The camels are most concentrated in eleven arid districts of Rajasthan which account for almost 59.3% of total Indian camel population where camel density is estimated to be 3.6 per Sq. Km and 4.78 per 100 persons constituting almost 10% of total herbivore livestock biomass. Traditionally, the camels are bred and managed in India under extensive management system. However, the camels are also kept in small numbers under intensive system when utilised for transport, load pulling and agricultural work.

The camel is a very versatile working animal suitable for load pulling, traction and agricultural operations which are further supplicated as provider of milk, meat, hide and fibre. For short distance transport and agricultural operations in small holdings, the camel draught energy is quite cost effective.

1. Work performance potential

The draft camel can be used for variety of functions including cart pulling, drawing wheels, ploughing, carrying water, transport of man and agricultural produce etc. Camels may be used single or in pairs or even in combination with other large draught animals.

It has been estimated that camels can produce 0.6 to 1.1 hp at low speed and 0.5 to 0.9 hp at high speed for long periods. The camels can produce draught more than 20% of body weight as compared to 10-14% produced by other large domestic animal. As reported from Kenya 1 ha land can be ploughed by camel at 16 cm depth in 20 hr and Sudanese camel exerts one hp energy during ploughing and covers one hectare in 11.25 hours. Pakistani camels could pull upto one tonne load for short distance and 1/2 tonne at slow speed for long distance. According to draught capacity experiment currently under progress at NRCC, Bikaner, a well built camel weighing 650-750 kg could haul a load of 1.5 to 1.8 tonnes for 4 to 6 hrs covering a distance of 30-40 km without exhibiting signs of distress. The draught force varied from 90 to 120 kg amounting to 17-22% of body weight. The adult camels exhibited capacity to pull loads varying from 2.5 to 2.8 kg/kg live weight for a period of 4 hours at an average speed of 5 km per hour. However, the camels with pay loads at the rate 3 kg/kg live weight resented working beyond two hours after covering a distance of 10 km at one stretch. The comparison of traction stress of two wheel carts and four wheel carts revealed that the stress was comparatively much less in traction of four wheel carts.

The slender riding camel may cover upto 100 km per day at an average speed of 15 km per hour over long periods, while stocky pack dromedary with load varying from 160-500 kg cover 20-50 km per day at an average speed of 4-5 km per hour. A camel can keep pace of 16 km/hour continuously for 18 hours. It is reported that Pakistani camel covers 65-80 km in a day at slow speed and 128 km at a fast pace.

The observations on speed and strides of Indian camels at Bikaner reveal that the speed at walk ranges from 5.46 to 6.12 km/hour, at trot 10.33 to 15.49 km/h and at gallop 23-30- km/h. The length of stride ranges from 2.31 to 5.12 m from walk to gallop and duration of stride from 0.57 to 1.70 per

second at different gaits. The duration of strides, strides/second and speed during trot and gallop indicate Jaisalmeri camels to be more efficient followed by Kachchhi. During walk Bikaneri proved to be better than Jaisalmeri and Kachchhi.

Comparative study on speed and strides of male and female camel at NRCC, Bikaner shows that the speed of female camel is higher than the males during short distance run. The body measurements of the camel have also been found to be correlated with the work performance of camel. The leg length and neck length have positive correlation with the speed. The neck length, leg length and height at withers are also positively correlated with the length of strides.

It is suggested that the draught camels should be worked in the cold hours of the day for better performance. The camels utilised for ploughing should not be worked for more than 6 hours at a stretch. Information on work-rest cycle in camel is scanty. The results of endurance study at Bikaner reveal that ploughing camel may work for 4-5 hr and after this period the animal may exhibit clear fatigue symptoms.

2. Nutritive requirements

Camel weighing about 500 kg produce stractive effort equivalent to one sixth of its body weight which requires energy equivalent to 2275 kw or 8.2 Mj per hour. It is further estimated that daily energy requirement for 10 hr working of a camel weighing 500 kg live weight could be equivalent to 136 MJME/day and it is suggested as 0.31 MJME M/kg $^{0.75}$ for maintenance. The energy requirements of the work animal are determined taking into consideration the age, sex amount of draught generated and duration of draught. In general, the energy used by the working cattle and buffaloes ranges from 1.25 to 2.7 × maintenance energy. There is also suggestion that trained animals use metabolic energy more efficiently than untrained animals. It has been established that carbohydrates in the ruminant diet are converted to volatile fatty acids which

make up approximately 70% of ME intake. The increase in the protein intake upto the maintenance level is not necessary, provided the ration is well balanced. However, this situation is likely to change with the additional interest in milk and meat production of the work animals. The ration for camels weighing 350-400 kg, should contain 0.34-0.59 DCP. It is reported that 142 g DCP for 450 kg camels is equivalent to 1.4 kg DCP/b.wt$^{0.75}$. The daily requirement of camel for maintenance and 10 h work to be 136 MJME and 300 g DCP. The dry matter intake of the Bikaneri camel on *ad lib* feeding pulling a load of 1.5 to 1.8 tonnes for 4 h/day ranged from 1.8 to 2% of body weight. The metabolic energy requirements for 300 kg camel are equivalent to 75 kcal/kg $^{0.75}$/day. It is revealed that camel can use metabolic energy contents of the diet for body tissue gain with efficiency of 68%, which is higher than most of the draft animals. It has been estimated that 500 kg camel expends 0.21 Mj gross energy per minute at sub maximal training speed of 15 to 18 km/h. The observations at Bikaner revealed that during short term work stress there is no significant initial difference of DMI during work and rest period while the water intake is higher during the rest period which followed work stress. Mineral and vitamin requirements of the working camels have not been established. However, it is presumed that NRC recommendations for cattle and horses may serve as adequate guide. Additional quantities of certain minerals e.g., calcium, phosphorus, chloride and vitamins are likely to prove beneficial.

3. Camel drawn implements

A number of camel drawn implements such as ploughs, harrows, cultivators, sowing ridgers, furrowers, land leveller, carts of both two and four wheels, water tanks, water drawing wheels, oil expeller, sugercane juice expeller have been developed and are commonly used. There is large scope of research and development of such implements. Successful camel operated equipments are yet to be developed in some

areas like planting, transplanting, harvesting, threshing, chaff cutting etc. Further, much efforts have not been made to develop twin or multi batton tools, rotary tools, oscillating tools for camels which require less draught power to operate.

4. Breeding programmes for draught camel

While considering the need for genetic improvement for draught, it is necessary to recognise the multi-purpose role of animal in the existing livestock production system. Genetic improvement for draughtability through selection will be slow and will require large and sophisticated infrastructure. Therefore, genetic improvement should be primarily directed towards increasing growth rate, fertility and reproductive efficiency, which will have direct positive impact on draught animals. Culling procedure should take care of physical, genetical and congenital defects. Genetic improvement of draughtability will be more feasible using crossbreeding or grading-up with known breeds/strains having superior draught power and endurance. There is need for evaluation of draughtability and racing potential of different camel breeds. Research efforts should be more effectively spent in other areas which will potentially benefit draught output. The research which links production with draught would have greater impact and acceptability than research concentrated on genetic improvement on draught alone.

5. Health of working camel

The draught and riding camel suffer from similar different diseases that are prevalent in the population. Few observations have been made on relative susceptibility of draught camels specific to the stress of work. On disease of Indian camels locally called 'Kumri' is specifically of great disadvantage to the riding camel where animal violently shakes its hind quarters and is unable to sit in normal time. No specific etiology or treatment for this disease is available. Other common problems of working camels are fractures, fragile bones, harness wounds, wounds at chest pad, and foot

pads, torn nostrils, diseases of pedestral, arthritis, chronic infective diseases, internal and external parasites and nutritional deficiency diseases.

6. Sustainable camel production in rural economy

In the subsistence economy in the desertic areas, camel rearing can be regarded as fairly constant resource to the rural poor farmers. This is supported by the fact that there has been constant increase in the camel numbers over the years inspite of its getting lowest priority amongst the domesticated animals. The Indian camel population have increased from 0.65 m in 1945 to 1.45 m in 1990. In order to improve camel herd growth and turnover risk linked to replenishment and long term caiptal gains, appropriate herd management, disease control, marketing and proper utilisation of camel resources are necessary. It is now observed that at present large camel breeding herds are owned by a few comparatively well to do farmers and these animals are given for management to poorer landless labourers. These labourers are either employed as paid labourers or are given certain number of camel calves as a compensation for the service rendered for managing the camel herd.

Marketing of camels is an important trade in the arid lands. Many livestock fairs are held all over Rajasthan. At these fairs large number of camels are brought for sale and purchase. The general price level has been increasing substantially over the years and providing camel linked job opportunities, vocation and economic subsistence to the camel breeding communities.

Findings of the evaluation studies on Integrated Rural Development Programme (IRDP) in Rajasthan indicated that average increase in income of the beneficiaries was highest amongst people who were given loan for the purchase of camels and camel carts. According to this study about 73-80% of the loan is distributed for the purchase of camel and camel carts. The credit flow is substantially higher in this sector and

is predicted to increase in years to come. Economic analysis of bullock and camel power use on farms in Haryana revealed that maintenance cost (base 1985-86) of a pair of bullocks on cultivated farm is higher than cost for camel. This study also indicated that the bullocks and camels both were under utilised. The average working days per year is 163.33 days. Therefore, attempt should be made to use remaining draught power either in custom hiring service or transport; alternatively, this power may be diversified for other non-conventional uses such as grinding, chaffing etc. A survey conducted in Chandan village of Jaisalmer district, Rajasthan, during 1986-88 indicated camel energy to be not only cost effective but also remunerative. Studies on dynamics of livestock energetics in the western Rajasthan from 1961 to 1983 revealed 32% increase in the camel energetics.

It is well recognised that the camel has deep rooted cultural significance to societies in the desertic areas. The multidimensional utilisation of camel for draught, milk, hair, hide and ecological adaptation to the desertic zone provides wide scope of camel energy utilisation in a sustainable manner. However, it is necessary to take safeguard that camel development need not complete with the development of other major livestock, for example, cattle, buffalo, sheep and goats. It has been emphasised that the camel development should be need based and should play supplementary role in the area development.

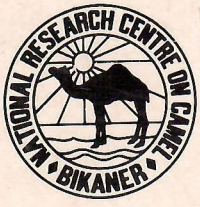
Encouraging camel production and utilisation will provide job opportunities to the local rural population and help in economic uplift of the area, whereas, encouraging tractor which requires high initial investment will provide economic advantage to rich people and also increase utilisation of petroleum products which are already scarce and consumes valuable foreign exchange. The petroleum products and high cost required for mechanised tractors can be utilised elsewhere. Camel is better alternative to tractors in the arid

areas since (i) there is local knowledge on how to take care of camels (ii) camels are adapted to the environment (iii) a camel represents low investment.

camels are also reared as racing animals. Breeding and management of racing camels are becoming very lucrative business particularly in the Gulf countries. Prices of young race camels have been indicated in the range of US $ 3,000 to 5,000 i.e. approx. Rs. 0.9 to 1.5 lakhs. This is another area where necessary research and development have great scope for camel herders particularly for the Indian Jaisalmeri camel breed which has fine racing potential.

Conclusion :

Summing up, it can be said that the camel can play extremely important role in augmenting economically sustainable livestock production system in the Indian arid zone. The untapped potential of camel are, however, required to be explored optimally, particularly, the use of camel milk, hair, hide and meat. The camel power which is under utilised should also be utilised for other diversified utility so that the camel rearing becomes more economical. It is emphasised that the camel development activities should be strictly need based and should not impose superfluity risk on the current camel management system.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