

Indian Draught Animals Power

K.L.Phaniraja* and H.H. Panchasara¹

Assistant Professor (OPG)
Department of Veterinary Microbiology, Veterinary College,
Karnataka Veterinary, Animal and Fishery Science University, Hebbal, Bangalore-560024
* Corresponding author email: drpaniraj@gmail.com

Abstract

With the modernization of agriculture, the use of mechanical power in agriculture has increased but draught animal power (DAP) continues to be used on Indian farms due to small holdings and hill agriculture. More than 55% of the total cultivated area is still being managed by using draught animals as against about 20% by tractors. India possessed the finest breeds of draught animals. Bullocks, buffaloes and camels are the major draught animals for field operations. Horses, mules, donkeys, yak and mithun are the pack animals for transport. The quality of work from the draught animals depends upon the power developed by them. The design of traditional implements is based on long experience and these have served the purpose of the farmers. However there is plenty of scope to improve the design based on animal-machine-environment interaction so as to have more output and increased efficiency without jeopardizing animal health.

Keywords: Draught Animal, Agriculture, Breed, Mechanization.

Introduction

Global food supply is currently enough to meet the food needs of the world's population, yet hunger persists (Islam, 1995; Johnson et al., 1999). Over 850 million people around the world are undernourished with, nearly three quarters of them living in rural farming communities in South Asia and sub-Saharan Africa (Smith et al., 2000). Future increase in global population is projected to occur mostly in developing countries, where soil, water, and farm power resources are already under great stress (Fischer & Heilig, 1997 and Cohen, 2003). Food security for 850 million populations is achievable partly through improvements in farm power availability to the resource poor farmers (Rosegrant & Cline, 2003). From pre-historic times when man changed status from hunter-gatherer to settled agriculturist, he harnessed the muscle power of large domestic animals to augment his own physical efforts in food production and leisure. Nowadays in any agricultural crop production system, humans, draught animals and engines or motors provide the motive power in various proportions for crop production, harvesting, transport and processing (Rijk, 1989; FAO, 2003; Pearson, 2005).

Draught animal technology is a reliable and popular farm power resource in most developing countries. However, despite its growing popularity,

animal traction farmers face several constraints such as rapid ploughshare wear, high draught forces and poor design of harnesses and other implements. Animals continue to be major source of motive power of India and used by majority of the small farmers. Draught animal power (DAP) is a classic example of large-scale application of appropriate technology concepts to millions of small and marginal farmers for cultivation and small-scale transportation. In 1961 the contribution of the draught animals to the total energy requirements of the farming system was 71 per cent, by 1991 this has come down to 23.3 per cent almost all operations other than land preparation switched over to electrical and mechanical sources of power, even ploughing of land is progressively being brought under mechanization (Anonymous, 1996). However, ploughing and tilling of land to a very large extent are still draught animal based even where ploughing and tilling operation are carried with tractors, other operations like interculture and seed drilling are almost exclusively carried out with work bullocks.

Importance of Draught animals

Draught animals play a dominant role in our rural economy. The draught power of our 83 million draught animals is estimated at equivalent to 30,000 MW in terms of electric power, equivalent to half the present generation capacity of India. In terms of energy, it is

1. Livestock Research Station, Veterinary College, Dantiwada, Sardarkrushinagar - 385 506

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Table-1. Number and Area of operational holdings by type of holding

Source of Holding (ha.)	Number ('000)			
	1985-86	1990-91	1985-86	1990-91
Marginal (below 1 ha)	56,147 (57.8)	63,389 (59.4)	22,042 (13.4)	24,894 (15.1)
Small (1 to 2 ha.)	17,922 (18.4)	20,092 (18.8)	25,708 (15.6)	28,827 (17.4)
Semi-medium (2 to 4 ha.)	13,252 (13.6)	13,923 (13.1)	36,666 (22.3)	38,375 (23.2)
Medium (4 to 10 ha.)	7,913 (8.2)	7,580 (7.1)	47,144 (28.6)	44,752 (27.0)
Large (10 ha. and above)	1,918 (2.0)	1,654 (1.6)	33,002 (20.1)	28,659 (17.3)

*Figures in brackets indicates per cent contribution Source: Agricultural statistics at a glance, 1998. Direct. of Econo. And Statist. Ministry of Agriculture, Govt. of India.

equivalent to 50,000 million units worth Rs. 10,000 crore. At present draught animals are being used to plough around 100 million hectares of farm land in India, which forms 60 per cent of total cultivable area, (transport 25,000 million ton Km of freight per year saving 6 million ton of diesel worth Rs. 4,000 crore annually) (Singhal, 1999).

Although an increasing mechanization is replacing the animal power in the villages, reducing the total DAP, yet India has to depend on animal energy for many years to come from agricultural operations and transport of farm produce. The net sown areas increased from 133 to 142.82 million hectares and gross cropped area 153 to 185 million hectares during the last two decades (Anon, 1998). The draught animal power has not been found adequate and, thus this is being supplemented by mechanical power especially for tillage, irrigation and threshing (Singh, 2001).

Ninety percentage of land holdings are distributed in marginal to semi-medium farm holdings. It covers about 50 per cent of total cultivable land. This asset has been cultivated using farm animals like bullocks, buffaloes and camels, where tractors and tillers, uneconomic, besides being too expensive for small farmers. Fragmentation of land is also continuing. In such situation DAP is important.

Draught animal growth : Zebu cattle (*Bos indicus*) and buffalo (*Bubalus bubalis*) are major sources of draught animals in India. In most part of the country only male bovine are used for draught purposes. Cows are generally not used for draught work due to social and religious consideration. Only in few eastern and southern states, female bovine which are generally not calved (heifers), are used for draught work.

The castrated male cattle over three year of age

Table-2. Population of Draught Animal for field operations (in million)

Animal	Year					Annual growth
	1961-62	1971-72	1981-82	1986-87	1991-92	
Cattle Male	72.56	61.05	63.78	61.10	58.53	- 0.20
Female	2.07	2.04	1.95	1.91	1.87	
Buffalo Male	7.61	7.32	6.56	6.25	5.94	- 0.20
Female	0.37	0.33	0.68	0.84	1.03	
Camels (M&F)	0.49	0.41	0.36	0.32	0.29	- 0.19
Total animal pair	41.80	35.79	36.86	35.77	33.98	

Source: 'Data book on mechanization and agro-processing since Independence' by Dr. G. Singh, Director, CIAE, Bhopal, cited in Agriculture, Res. Data Book (1998) IASRI, New Delhi.

Table-3. Cattle as a Draught Animal Power source (in million) (1987)

Cattle 195.867	Crossbred 12.79 M (6.53%)	Indigenous 183.077 M (93.47%)
Male	4.278 M (2.18%)	94.407 M (48.20%)
Female	8.513 M (4.35%)	88.67 M (45.27%)
For draught works	2.143 M	61.64 M + 1.95 M
Total Draught Cattle	65.733 M (33.56%)	

Source: 'Data book on mechanization and agro-processing since Independence' by Dr. G. Singh, Director, CIAE, Bhopal, cited in Agriculture, Res. Data Book (1998).

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Table-4. Characteristic of Cattle Breeds of India.

Breed	Distribution & Habitat	Wt. Kg	Functional characteristics, Size and use
Dangi	Gujarat. Area covered by the northern portion of the western ghats. (A'nagar, Nasik, Thane of M's & Dang and Surat dist. of Gujarat)	364-455	The bullocks are excellent for all general agri-work and are extensively used for paddy cultivation and road transport, Medium sized, fast working draught animal
Haryana	Rohtak, Hissar (Haryana state), Punjab, Rajasthan, U.P.	371-489	Good work animal particularly for fast ploughing and road transport
Kangayam	Southern and south-eastern areas of Coimbatore, T.N.	477-546	Powerful and known for fast work, Moderate size
Kankrej	South-east of the Rann of kutch. Extending from the SW corner of Tharparkar dist. of sind (Pak) to Dholka in Ahmedabad.	455-682	Excellent, known for fast work Heaviest of Indian Cattle
Khillari	i. Aundh, Jat & Sangli ii. Sholapur & Satara & Satpura	455-500	Powerful, draught animal throughout the state of Maharashtra, Excellent, Medium-paced draught animals
Malwi	Part of M.P & Raj. Distributed practically in the whole of Malwa tract	-	Breed is known for its draught capacity. Bullocks are active and strong and are excellent in ploughing, carting heavy loads and for lifting water
Nimari	Narmada valley tract in M.P	386-523	Docile and good at work
Ongole	Ongole tract of A.P Nellore district	546-682	Bullocks are powerful and good for heavy ploughing and for cart work, Not considered suitable for fast work
Bachaur	North Bihar	385.5	Medium draught ability
Baslao	Southern M.P., M's	431.0	Good worker
Kenkatha	U.P	344.0	Sturdy and fairly powerful
Kherigarh	Lakhimpur-Kheri dist. of U.P	476.0	Good for light draught and trotting purpose
Krishna Valley	Along the river Krishna and area of Ghataprabha and Malaprabha in Karnataka	499.0	Powerful and suitable for slow draught and heavy ploughing
Nagori	Jodhpur and Nagore dist. of Rajasthan	408.0	One of the most useful draught breeds of India. Generally employed for road work.
Ponwar	Pilibhit and Lakhimpur, Kheri in U.P	317.5	Used for plough and load milk

Source: Characteristics of Cattle & buffalo breeds in India, ICAR (1979). By Banerjee (1998).

(2.5 year in cross bred) are used as draught animals – classified as 'animals for work'. Un-castrated bulls and buffaloes are also used for draught purpose (7.5% of the total working bullocks and 26.5% of the total working buffalo) (Singh, 1999).

During 1961-62 to 1991-92, the population of working bovine has reduced from 77.81 to 77.69 million, registering negative growth of 0.20% per annum.

It is clear from above table-2. that DA's population of cattle and buffalo reduced from 41.80 million animal pairs in 1971-72 to 33.98 million animal pairs in 1996-97.

Draught cattle breeds

India has better draft breeds, however, the number of pure breed cattle is hardly 20 per cent of the total cattle population. Most famous draught breeds are Haryana, Nagori, Amrithmahal, Sahiwal, Kankrej,

and Malwi etc. The crossing of cows is mostly carried out with the Jersey, Holstein Friesian, Brown Swiss and Red Dane with well-known local breeds like Sindhi, Sahiwal, Haryana, Gir, Kankrej etc. for higher milk production and better draft animals. The crossbred animals are hump less. Absence of humps in crossbreds did not pose any problem during ploughing and carting operations (Acharya et al., 1979; Singhal et al., 1996). These animals have better pulling capacity as compared to local breed. However these are not resistance to high environment temperature.

Machines Vs. Draught Animal

The cropping season generally lasts for only some 30 days during Kharif and 30 days during Rabi or a total 60 days in a year 70 million bullocks exclusively used over 60 days, for cultivation, 6 hr each day, account for a total power output of some 9450

million KWH or power units work animals are used only for 100 days in a year for all purposes together (cultivation and transportation). Their total work output for the 100day period. The average working year for a work bullock would be 15750 million KWH or units.

On the basis of coverage of land, one bullock pair can cultivate some 0.33 ha in a 6 hr working day. For cultivating 176.66 million ha (gross cropped area in 1987) over a 60-day period, the work animal force required was only 8.6 million pairs of bullock. Alternatively, if the entire cultivation operations were to be completed in a 30 day period 15 days each for Kharif and rabi, then a total of 17.2 million pairs would be required and we had in 1987, some 35 million pairs. This is however not to conclude that the 70 million bullock were surplus their spatial distribution over millions of holdings all over the country and agri. Operation are time bound. Singhal et al (1996) reported that 70 min DAP available farm power and about 32% of energy used in the rural sector in the country.

A 35 HP tractor can plough (mould board plough) some 2.5 ha in an 8 hr shift and would consume some 4 to 5 lits of diesel per hr for such operation (coverage of area and diesel consumption varies for different operations but for the sake of these calculation the most heavy task is chosen) 176.66 mln ha of land can be ploughed over a 60 day period, coinciding with the cropping season in Kharif and rabi by some 1 mln tractors working one shift per day or 0.5 mln for two shift per day. Alternatively, all the ploughing in 30 days, 15 days in Kharif and 15 days in rabi. Tractors in India therefore are committed to crop production only for 30 to 60 days and are available for other use over a 300 to 330 day period, in a year (Anon, 1996).

In 1987, India had somewhere between twice to four times the number of DA's than was necessary to cultivate the total gross cropped area of 176.66 mln ha. Even in 2010 A.D. when grow cropped area is expected to increase to some 200 mln ha and irrigated

area to some 110 million hacter - the country will have a surfeit of Das for cultivating land, even at their present population size. Increased farm power needs will be for increased irrigation, exclusively met from electrical and mechanical sources even today. Land cultivation will still be partly by the increased number of tractor and power tillers but largely by DA.

Therefore very large wastage of potential in DAP system. The reasons given by Singhal et al. (1996) as;

1. Availability of poor breed of DAP
2. Under utilization and misuse of animals
3. Injurious and less efficient harnesses
4. Poor feed and lack of health care coverage
5. Inefficient conversion of draft efforts into work done due to poor design of implements
6. Use of inefficient traditional animal carts
7. Improper management of DAP.

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