

Challenges in reinvigorating draft animal power in India and some opportunities

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Abstract

Bullocks provide farmers with an efficient, cost-effective, and sustainable means of performing various agricultural tasks. In many rural areas, draft animal power continues to be relevant and plays a vital role in supporting agricultural activities, particularly for small-scale farmers. Fragmentation of land over generations is a continuing process and it does not spur the use of tractors or minor machines, or even tillers. Hence, draft animal power will continue to be relevant in the existing situation of small land holdings. Their strength, adaptability, and cultural importance make them valuable assets in many farming systems in the country. Specialized attention including legislation for welfare of draft animals and systematic animal breeding programs exclusively for draft purpose will further help promote draft animal power. The benefits they bring to sustainability by saving on fossil fuel use, and promoting biodiversity can make them valuable assets in agricultural systems of any country.

Résumé

Les bœufs fournissent aux agriculteurs un moyen efficace, rentable et durable d'effectuer diverses tâches agricoles. Dans de nombreuses zones rurales, la traction animale reste pertinente et joue un rôle essentiel dans le soutien des activités agricoles, en particulier pour les petits exploitants. La fragmentation des terres au fil des générations est un processus continu qui n'encourage pas l'utilisation de tracteurs, de petites machines ou même de motoculteurs. Par conséquent, la traction animale restera pertinente dans le contexte actuel des petites exploitations agricoles. Leur force, leur adaptabilité et leur importance culturelle en font des atouts précieux dans de nombreux systèmes agricoles du pays. Une attention particulière, notamment une législation sur le bien-être des animaux de trait et des programmes systématiques d'élevage exclusivement destinés à la traction animale, contribuera à promouvoir davantage la traction animale. Les avantages qu'ils apportent en matière de durabilité, en permettant d'économiser les combustibles fossiles et de promouvoir la biodiversité, peuvent en faire des atouts précieux dans les systèmes agricoles de tous les pays.

Kurzfassung

Zugrinder bieten Landwirten eine effiziente, kostengünstige und nachhaltige Möglichkeit, verschiedene landwirtschaftliche Aufgaben zu erledigen. In vielen ländlichen Gebieten ist die Zugkraft von Tieren nach wie vor Bedeutung und spielt eine wichtige Rolle bei der Unterstützung landwirtschaftlicher Aktivitäten, insbesondere für Kleinbauern. Die Fragmentierung von Land über Generationen hinweg ist ein fortlaufender Prozess und fördert nicht den Einsatz von Traktoren oder kleineren Maschinen oder sogar Bodenfräsen. Daher wird die Zugkraft von Tieren in der bestehenden Situation kleiner Landbesitze weiterhin relevant sein. Ihre Stärke, Anpassungsfähigkeit und kulturelle Bedeutung machen sie zu wertvollen Ressourcen in vielen landwirtschaftlichen Systemen des Landes. Besondere Aufmerksamkeit, einschließlich Gesetzen zum Wohlergehen von Zugtieren und systematischen Tierzuchtprogrammen ausschließlich für Zugzwecke, wird dazu beitragen, die Zugkraft von Tieren weiter zu fördern. Die Vorteile, die sie für die Nachhaltigkeit durch die Einsparung fossiler Brennstoffe und die Förderung der biologischen Vielfalt mit sich bringen, können sie zu wertvollen Ressourcen in den landwirtschaftlichen Systemen jedes Landes machen.

Resumen

El ganado de tiro ofrece a los agricultores una posibilidad eficaz, económica y sostenible de realizar diversas tareas agrícolas. En muchas zonas rurales, la tracción animal sigue siendo relevante y desempeña un papel fundamental en el apoyo a las actividades agrícolas, especialmente para los pequeños agricultores. La fragmentación de la tierra a lo largo de generaciones es un proceso continuo y no fomenta el uso de tractores o máquinas pequeñas, ni siquiera de escarificadores giratorios. Por lo tanto, la fuerza de tracción animal seguirá siendo relevante en la situación actual de pequeñas propiedades agrícolas. Su fuerza, adaptabilidad e importancia cultural los convierten en recursos valiosos en muchos sistemas agrícolas del país. Una atención especial, incluyendo leyes sobre el bienestar del ganado de tiro y programas sistemáticos de cría de animales exclusivamente para fines de tiro, contribuirá a promover aún más la fuerza de tracción animal. Las ventajas que aportan a la sostenibilidad al ahorrar combustibles fósiles y al fomento de la biodiversidad pueden convertirlos en recursos valiosos en los sistemas agrícolas de cualquier país.





Fig. 1 Bullocks in Telangana state (Picture: D. K. Sadana).

Introduction

Since ages, bullocks have been an integral part of Indian agriculture. Even though there has been a huge reduction in the number of draft animals in the country, yet hilly and tribal areas, small and marginal farmers, and fragmented fields continue to benefit from and hence support the survival and continuity of bullocks. Larger attention to mechanized farming (in view of the need for voluminous food) and a general neglect of bullock system even in the areas where these seemed competitive has led to drastic reduction in their numbers. A spurt in attention to natural and ecological farming in recent years, has augured renewed efforts to revisiting the bullock based systems. Some efforts made in this regard have highlighted the challenges confronted in search for avenues to promote their use. This article is an attempt to revisit the challenges faced and, in the process, possibly find a path or 'a road ahead'. This has an assured global relevance in view of the imminent climate change.

Draft Animal Power (DAP) in India

At the turn of the century – just a quarter century ago – Draft Animals were the main source of power for agricultural activities in more than half of India's farm land. DAP has remained the source of energy for ploughing and other agricultural operations as well as for haulage. Draft animals covered 60 percent of total cultivable area (around one hundred million hectares) for agricultural operations and also saved around 6 million ton of diesel

by the transportation of 25,000 million ton Km of freight per year¹. Rising human population in the recent decades and the concomitant steady increase in cropped area also increased the demand for farm-power. It has been noted that during the Eighties and Nineties there was around 21% increase in gross cropped area in the country². Around the same time tractors and other forms of mechanical power started becoming available to meet the gap (of required farm power) and also to provide speed to operations like tillage and irrigation. Mechanical systems (mainly tractors) made inroads especially in the vast expanses of plain regions like Punjab, Haryana and Uttar Pradesh.

As a consequence, bullocks started reducing in numbers. Reduction was, however, slow in the regions like hilly, rainfed and non-irrigated areas that, to a good extent, continued the use of bulls and bullocks. One important reason why the bullocks find a continuity is: large number of relatively small size of land holdings by individual families. As also confirmed recently, small and marginal holdings (below two hectares) constituted 86% of the total land holdings covering half the total cultivable land in the country³. Earlier, Phaniraja and Panchasara had reported that more than 55% of the total cultivated area in the country was still managed by using draft animals as against about 20% by tractors⁴.

1 Phaniraja/ Panchasara 2009.

2 Anon 1993.

3 Anon 2019.

4 Phaniraja / Panchasara 2009.

This trend has marginally changed in the recent years. Despite the advent of mechanization, however, DAP is relevant even today at least in half of the country. Bullocks, in small or large numbers, are available and continue to serve in all the different states. Also, the other working livestock (buffalo, camel, equine, mule, donkey, yak and mithun) are each regionally important based on the local ecosystem and make valuable contributions to agriculture and transportation.

In hilly and drier regions, tractors and tillers are uneconomic; being expensive for small farmers. In a study on economic utilization of tractor per annum, it was shown that the break-even point for owning a tractor is more than 400 hours⁵. Only the large farmers can manage this much usage in a year. Small/medium farmers, if they do not own at least one bullock, find it more convenient to hire a tractor on hourly basis.

Bullock-driven Agriculture

Farmers harness strength of bullocks to carry out labour-intensive work without relying solely on human effort. Bullocks are highly adaptable and can work in muddy, marshy or uneven fields, steep slopes, small terraced farms, and narrow pathways where machinery may have difficulty operating. Their maintenance costs are lower than that of modern machinery, making them a practical choice for resource-limited agricultural communities. As the bullocks are highly adaptable, there are situations where small farmers were able to undertake timely operations in the face of climatic uncertainties like drought or excessive rainfall. Hence, the bullock owners, to a good extent, were able to manage labour for farm operations.

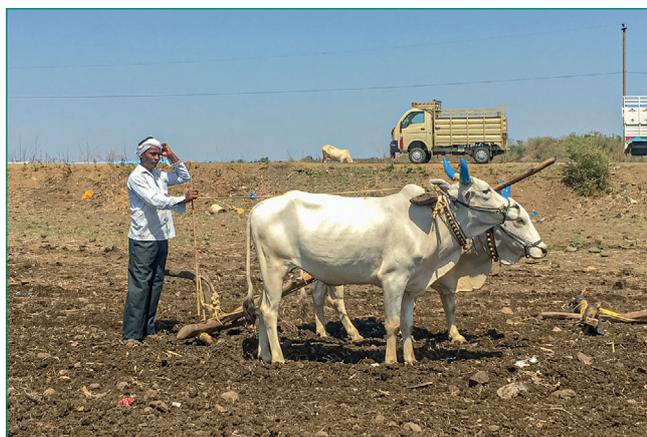


Fig. 2 Bullocks used for cultivation in the state of Maharashtra (Picture: D. K. Sadana).



Fig. 3 Bullock use for taking out oil from coconut or from nuts in Andhra Pradesh (Picture: D. K. Sadana).

Bullocks are often more affordable as compared to machinery and can be purchased or bred on the farm. Additionally, bullocks can graze on common pastures and consume agricultural byproducts available at relatively lower cost or produced at the farm itself. Even when the bullocks are working in the fields, they help improve soil by softly breaking up compacted soil and raising aeration for better root-penetration. They also incorporate organic matter into the soil improving its fertility and structure. Unlike the tractors, they minimize soil compaction and promote better crop yields. Especially useful in drier regions - the lesser soil manipulation by the use of bullocks significantly saves soil moisture.

Bullocks are an integral part of natural and ecological farming. Use of bullocks eases transition to biodiverse multi-crop mixed natural farming systems. Farm activities like land preparation and weeding are more effectively achieved by using bullocks than by using machinery. Thereby, the use of bullocks makes farming practices more environment-friendly. Bullocks offer renewable energy and a sustainable alternative to heavy machinery, significantly reducing the carbon footprint of agriculture. Moreover, unlike the fossil-fuel consuming tractors and machinery, bullocks do not emit harmful greenhouse gases and do not contribute to environmental pollution. The reduced reliance on fossil fuels aligns with eco-friendly practices. Bullock-driven farming also contributes to the preservation of diverse ecosystems. Akila and Chander (2009) opined that draft bullocks are better than tractors for small and marginal farmers when the farmers can meet out the feed cost by their own sources or grazing in common lands and the number of work days are improved⁶.

At many places across the country, bullocks are an integral part of the local systems, holding cultural significance in many societies, representing agricultural heritage and local traditions. Their use in farming practices helps preserve local customs, socialising and maintaining the traditional knowledge associated with agriculture. Their presence preserves cultural identity and fosters a sense of community pride. At the same time, the minimized use of machinery helps protect wildlife habitats, ensuring a balanced coexistence between agriculture and nature.

5 Shambhu / Chaudhary 2012.

6 Akila / Chander 2009.

A. Draft Cattle Breeds (major state where present)	B. Dual-purpose Cattle Breeds (Draft as well as Milk)
01. Amritmahal (Karnataka)	23. Badri (Uttarakhand)
02. Bachaur (Bihar)	24. Belahi (Haryana)
03. Bargur (Tamil Nadu)	25. Binjharpuri (Odisha)
04. Dagri (Gujarat)	26. Dangi (Gujarat)
05. Hallikar (Karnataka)	27. Deoni (Maharashtra)
06. Himachali Pahari (Himachal Pradesh)	28. Gangatiri (Uttar Pradesh)
07. Kangayam (Tamil Nadu)	29. Gaolao (Maharashtra)
08. Kenkatha (Uttar Pradesh)	30. Ghumusari (Odisha)
09. Khariar (Odisha)	31. Haryana (Haryana)
10. Kherigarh (Uttar Pradesh)	32. Kankrej (Gujarat)
11. Khillar (Maharashtra)	33. Kathani (Maharashtra)
12. Konkan Kapila (Goa and Maharashtra)	34. Krishna Valley (Karnatak)
13. Kosali (Chhattisgarh)	35. Ladakhi (Ladakh)
14. Ladakhi (Ladakh)	36. Lakhimi (Assam)
15. Motu (Odisha)	37. Malnad Gidda (Karnataka)
16. Nagori (Rajasthan)	38. Malvi (Madhya Pradesh)
17. Nimari (Madhya Pradesh)	39. Masilum (Meghalaya)
18. Poda Thurpu (Telangana)	40. Mewati (Uttar Pradesh and Rajasthan)
19. Ponwar (Uttar Pradesh)	41. Nari (Rajasthan)
20. Pulikulam (Tamil Nadu)	42. Ongole (Andhra Pradesh)
21. Siri (Sikkim and West Bengal)	43. Punganur (Andhra Pradesh)
22. Umblachery (Tamil Nadu)	44. Purnea (Bihar)
	45. Red Kandhari (Maharashtra)
	46. Sanchori (Rajasthan)
	47. Shwet Kapila (Goa)
	48. Tharparkar (Rajasthan)
	49. Thutho (Nagaland)
	50. Vechur (Kerala)

Tab. 1 Draft cattle breeds, and breeds maintained for dual purpose.

Livestock providing DAP

Amongst all the livestock species, bullocks are the major contributor to Draft Animal Power. Thus far there are 53 registered cattle breeds in the country. Of these 22 breeds are considered as 'Draft type' (See Tab 1: *Draft cattle breeds, and breeds maintained for dual purpose*). The draft breeds are well spread out in different parts of the country and continue to provide farm-power effectively in their respective regions. In the year 2010, research organizations in India (notably the ICAR-NBAGR, National Bureau of Animal Genetic Resources located at Karnal-132001) had undertaken to locate, identify and document new livestock breeds for registration in the national gazetteer. Interestingly, the recently identified breeds of cattle (numbering 23) are all of draft type. Milk breeds were documented long ago, but draftability as a capacity (or as a trait in selection programs) has not been given due consideration. At least half of the 22 draft breeds in the country are highly reputed for their draftability. The list starts with *Nagori* breed of Rajasthan valued for its strength and endurance in the arid and semi-arid landscape and often marked as the best draft breed in the country. Some more breeds in elite draftability list are: *Amritmahal*, *Kangayam*, *Khillar*, *Nimari* and *Umblachery*. Moreover, *Haryana* and *Kankrej* – both dual-purpose (draft and milk) breeds - have excellent draft qualities. All the draft breeds are well adapted to their respective regions and positively contribute to field operations/transportation.

Farm Implements using DAP

The traditional implements are based on long experience and these have broadly served the purpose of the farmers. Carts, in general, are of traditional type with a large wooden wheel fitted with an iron rim. Axle and bearings are loose, as a result of which energy is wasted and efficiency is low. Efforts have been made in designing new implements based on animal-machine-environment interaction and showing higher efficiency in farm conditions. Only a few of these new implements have been accepted under the field conditions. Slow penetration of the newly developed implements together with the easy availability of the non-DAP mechanized systems has led to closure of such research projects.

Meeting inadequacies in DAP

In respect of welfare of DAP animals, there are situations where the draft animals face insensitive treatment like 'no rest during long hours of work', 'spikes' that cause pain, nose ropes, injury on the body part that is constantly hitting the yoke etc. During their working life the animals are subject to such inadequacies which could be prevented by humane care and adopting simple measures. Basic provisions need be provided - like appropriate well-fitting equipment for lower fatigue and preventing injury while working, prevention of overstraining, appropriate and sufficient feed to ensure health and energy for work, general and ethnoveterinary health care, allowing working ani-

mals to rest from work at regular intervals and allowing them the freedom to satisfy their natural instincts. Special attention must be given in case of injuries and sickness or forcing the animals to work in adverse ambient conditions. In general, adoption of painless methods for nose-roping, shoeing, branding, dehorning etc. are expected and need to be promoted. There are state laws to prevent any misuse and abuse of draft animals. Trainings and awareness can help observance of the laws. Some organizations like Animal Welfare of India and 'Animal Rahat' highlight and attend to such issues⁷.

Challenges in promoting DAP

While the benefits of bullock-driven agriculture are undeniable, there are challenges that come with maintaining this practice in the modern world. Widespread use of the bullocks might struggle to meet the demands of large-scale commercial agriculture due to their slower pace and limited capacity compared to modern machinery. At the field level, the other important challenge is: to be able to utilize the bullocks for a longer duration than just 2-3 months in a year. It is a common observation that the cropping season in India usually lasts for only around 60-70 days in a year – around 30 days in winter cropping (*Rabi* season) and bit longer during summer cropping (*Kharif*). Even though bullocks perform varied tasks and several field operations (viz. tillage, seedbed preparation, harrowing, ploughing, sowing, weeding, harvesting, threshing, winnowing, post-harvest operations as well as occasional but wider use in transportation, lifting of water, collection of oil from seeds etc.), keeping them idle for three fourth of a year doesn't make economic sense.

Working with bullocks demands a certain level of expertise and training. It is a challenge to keep the DAP system alive and relevant for the farmers who are also the keepers of traditional knowledge. Farmers/users must possess a deep understanding of animal behaviour and handling techniques. The traditional system of this knowledge passing from generation to generation is now weakening.

Furthermore, the newly developed implements in the organizational setup face the challenge of their acceptance at the farmer's level. How to further improve the DAP implements and involve media in raising awareness on imminent climatic problems are the other issues.

Opportunities for promoting DAP

Experiments have shown that selection of improved implements coupled with efficient harnessing systems is most likely to enhance the power output. The use of an improved yoke has made it possible to achieve 16–30% increase in draught capacity under sustained loading and 20–30% increase in field capacity of implements, resulting in an increase in command area of draught animals, compared to traditional yokes⁸.

In view of the low annual utilization of the bullocks for farming, alternate use can be enhanced e.g. agro-processing (and allied tasks) during idle periods by using rotary mode operations. This would require more efficient rotary gear systems for operating the DAP machines. Bullocks have been demonstrated to run on treadmill-like

machines and generate electricity⁹. Based on the pattern of hiring a tractor on hourly payment basis for field operations, WASSAN (an NGO cited above) has established resource centers for bullock-driven implements in some villages in Andhra Pradesh. Farmers in the villages and around can enquire and hire implements for use. With general availability of mobiles in the villages now (using the well-established digitization in the country) this concept (being termed as 'uberization') can be promoted into mobile based application for wider use of DAP implements from resource centers at present and possibly for the use of bullocks in future.

Hitherto, the state level subsidies for purchase of tractors, and the excessive promotion of 'tractors for farming' has generally disregarded 'bullocks for farming'. Wherever feasible and more efficient, utilization of bullocks must receive acceptance and also support in media which has ignored the environmental benefits of using bullocks and the pollution caused by tractors consuming fossil fuels. Some breed societies and self-help-groups are promoting bullock driven farming and instituted one state-level award (in 2021) for keepers of indigenous breeds of cattle and bullocks in Himachal Pradesh. Further support to this approach is expected to yield better results. Some efforts in developing new and innovative equipment for DAP have been initiated by civil society organisations like WASSAN¹⁰ and Manav Vikas Sansthan¹¹.

The integration of bullocks into modern farming practices showcases the harmony between tradition and innovation. Slowly, farmers are combining the strength and precision of bullocks with advanced technologies. This fusion marries the wisdom of generations with the possibilities of the future, creating a dynamic sustainable farming landscape.

Conclusions

Overall, bullocks provide farmers with efficient, cost-effective, and sustainable means of performing various agricultural tasks. In many rural areas, DAP continues to be relevant and plays a vital role in supporting agricultural activities, particularly for small-scale farmers. Fragmentation of land over generations is a continuing process and it does not spur the use of tractors or minor machines, or even tillers. Hence, DAP will continue to be relevant in the existing situation of small land holdings. Their strength, adaptability, and cultural importance make them valuable assets in many farming systems in the country. Specialized attention including legislation for welfare of draft animals and systematic animal breeding programmes exclusively for draft purpose will further help promote DAP. The benefits they bring to sustainability by saving the fossil fuels, and promoting biodiversity can make them valuable assets in agricultural systems of any country.

7 Animal Rahat 2023.

8 Netam/Jaiswal 2018.

9 The Indian Express 2022.

10 <https://wassan.org> (last accessed 06-10-25).

11 <https://www.rainfedindia.org> (last accessed 06-10-25).



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