

Long term study of declining animal usage in Indian agriculture

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Abstract: Traditionally in Indian agriculture draught animals enables farmers to increase agricultural production and improve the quality of life. However, in recent decades there has been a trend towards replacing draught animals with farm tractors. There is a rapid shift from animal to tractor power but the information about actual declining over the period is very little known. This paper presented results of four phase survey conducted for draught animal and animal powered implement usage in four different locations of central India. The result shows a reduction in range of 76.1% to 90.2%, in draught animal population and 58% to 91% in animal powered implements among these four locations of central India. Present approaches in agriculture inclined towards more use of heavy machines like tractors, combine harvesters, etc. The use of draught animals in small farms was becoming unattractive for various reasons viz. high maintenance cost of draught animals, higher fodder cost, limited working capacity, and drudgery. This reduction in animal and animal powered implement shows a huge transformation in Indian agriculture from traditional to machinery powered farming, but on the other hand it shows changing perception of youth in agriculture.

Keywords: animal population, animal power, draught animal, farmer's survey, small farm implements

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1 Introduction

In India, human power, draught animals, tractors, power tillers, diesel engines and electric motors in agriculture system are predominantly used as sources of farm power. The more use of farm machines of non-renewable fossil fuel adversely affects the environment (Chel and Kaushik, 2011; Guru et al., 2019; Lal et al., 2019), due to the higher output and efficiency of farm machines over the years (Shrivastava and Jha, 2011). Study shows that 1% increase in farm machine use rate tends to decrease draft animal use by 2.82% in the long-run results in lower down the number of draught animals

in farms (Zhou et al., 2018). The availability of draught animal power has come down from 0.133 kW ha⁻¹ in 1971-72 to 0.094 kW ha⁻¹ in 2012-13, whereas the share of tractors, power tillers, diesel engines, and electric motors has increased from 0.020 to 0.844, 0.001 to 0.015, 0.053 to 0.300 and 0.041 to 0.494 kW ha⁻¹, respectively during the same period (Mehta et al., 2014). In the context of animal operated implements, local plough, seed drill, tihan, blade harrow, bund former, and bullock cart are the most commonly used equipment (Starkey, 1989), but the number of these equipment are slowly reduced over time. In this evolution from traditional to modern agriculture, the commercial energy-based machinery are more used on the farms results in the rising cost of production and depleting energy reserves (Lal et al., 2020; Patel et al., 2018).

In agriculture, small and marginal farmers are using draught animal power for field cultivation. Compared to motorized mechanization, draught animal is found to be

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an appropriate and affordable technology for small-scale farmers in developing countries and result in higher economic efficiency (Guthiga et al., 2007). Draught animal power is still relevant and useful due to the fact that it is suitable to the needs of the farmers with small land holding and the areas where mechanized implements cannot be put to use (Singh et al., 2007). The working with bullocks not only contributes manure, conserve natural resources like fossil fuel, but also creates employment opportunities and generates income particularly for the small scale farmers in India (Akila and Chander, 2011). India possessed the finest breeds of draught animals (Phaniraja and Panchasara, 2009) and total of 60 million working cattle and buffaloes were used for various agricultural operations, saving fossil fuel worth Rs 60 billion, annually (Natarajan et al., 2016). Theoretically, the draught animal can only pull loads equivalent to about 10 per cent of their body weight. But, the traction machines, on the other hand, can produce a far higher output in a much shorter time-frame, depending on their size and rated capacity. A pair of bullocks, for instance, may take nearly five days to plough one hectare of land. In contrast, a tractor can do the same job in five hours. Main field preparation activity can be completed by a low power rating tractor in quick time as long hours are needed with bullocks. But the tractor and other machinery needed higher cost of operation and also needed non renewable energy sources, i.e., diesel, petrol etc. creating pollution and damaging the environment (Guru et al., 2018). The use of farm animals for field work in small farms is becoming unattractive for various reasons i.e., low interest of youths in agriculture and animals having high maintenance cost with limited working capacity because of low working speed. The usage pattern of animal and animal-based farm implements need to be conducted to generate the information about the changes in animal usage pattern over the years.

2 Material and methods

2.1 Study area description

Madhya Pradesh is located in the central part of India. The four villages selected are Singod (district-Jabalpur,

rice-wheat zone), Phanda (district-Bhopal, Wheat zone), Sonsa (district - Gwalior, Sorgham -wheat zone), Kanadia (district-Indore, cotton- Sorgham zone).

2.2 Study details

Four rounds of detailed study were conducted in four locations namely Singod, Phanda, Sonsa, and Kanadia. The 1st round of study conducted in year 1992- 1993, 2nd round in 1998-1999, 3rd round in 1999-2000, and 4th round in 2008-2009. The data was collected with the help of pre-designed and pretested questionnaire. The farmers were interviewed twice in rabi season to collect information, which include farmer's identifications, land holding, farm power, draught animal and machinery availability and usages.

3 Results and discussion

3.1 Animal population

In all the selected villages, the number of draught animals reduced to a greater extent ranged from 67.6% to 71.8% during 1992 to 1998 (Table 1). Rate of reduction slowed down there after till 2008-09. In initial years, the number of draught animals was 170 which declined to 35 in last survey in village Singod. In Phanda, Sonsa and Kanadia, the corresponding values were 238 and 23, 348 and 67, 1218 and 290 respectively. This result shows a declination of 79.4%, 90.2%, 80.7%, and 76.1% from first survey to last survey in villages Singod, Phanda, Sonsa, and Kanadia, respectively. Similar survey data shows there was 566.20 number of draught animals per thousand hectares in year 1960-61, which reduced to 367.23 in year 2013-14 (Singh et al., 2015). This trend happened because farmers believed in the fast work by tractor rather than slow work as farming intensity increased at a faster rate as well young farmers started believing in quick work rather than hard work, the maintenance of draught animal was also a big challenge. In surveyed area, the use of draught animal is for very limited and the animal power are not used throughout the year. To get the maximum profit draught animals should be used for double cropping, weeding, or for transport in addition to primary tillage (Guthiga et al., 2007).

As the number of animal reduced, the theoretical area covered/draught animal increased from 2.72 ha to 13.85

ha in Singod and the corresponding values were 5.10 to 54.26 ha, 0.99 to 5.07 ha and 1.21 to 5.18 ha/draught animal in Phanda, Sonsa and Kanadia respectively. The difference in use of animal power was very clear and it

can be said that the cultivators of Sonsa and Kanadia were using Bullock even during 2008-09 as its utilization was meager in Phanda.

Table 1 Availability of draught cattle in relation to population and cultivated area

| Village | Period | Total draught animal | Total area ha. | Human population | Draught Cattle/ha | Ratio of Human Population to Drought Cattle |
|---------|---------|----------------------|----------------|------------------|-------------------|---|
| Singod | 1992-93 | 170 | 463 | 730 | 2.72 | 4 |
| | 1998-99 | 55 | 470 | 552 | 8.55 | 10 |
| | 1999-00 | 54 | 474 | 544 | 8.78 | 10 |
| | 2008-09 | 35 | 485 | 539 | 13.86 | 15 |
| Phanda | 1992-93 | 237 | 1,215 | 1,580 | 5.13 | 6 |
| | 1998-99 | 75 | 1,239 | 1,356 | 16.52 | 18 |
| | 1999-00 | 63 | 1,242 | 1,337 | 19.71 | 21 |
| | 2008-09 | 23 | 1,248 | 1,272 | 54.26 | 55 |
| Sonsa | 1992-93 | 348 | 345 | 820 | 0.99 | 2 |
| | 1998-99 | 98 | 323 | 465 | 3.3 | 4 |
| | 1999-00 | 90 | 325 | 459 | 3.61 | 5 |
| | 2008-09 | 67 | 340 | 440 | 5.07 | 6 |
| Kanadia | 1992-93 | 1,218 | 1,475 | 3,431 | 1.21 | 2 |
| | 1998-99 | 343 | 1,500 | 2,039 | 4.37 | 5 |
| | 1999-00 | 306 | 1,499 | 1,978 | 4.9 | 6 |
| | 2008-09 | 290 | 1,502 | 1,966 | 5.18 | 6 |

3.2 Availability of animal drawn implements

During 1998-99, all the four villages were having more number of bullock drawn farm machinery that was reduced over time. Local plough (indigenous plough) was the most common tillage machinery followed by blade harrow (Bakhar), tiphon and bullock cart. During the 2nd survey, they were replaced by tractor drawn implements. In the village Sonsa, the number of bullock drawn implements during 1st survey was maximum i.e. 1.67 ha⁻¹ then reduced to 0.15 ha⁻¹ in the 4th survey. Iron plough was popular implement in the region followed by Dufan (two tines seed drill) and MB plough. Bullock cart was

the main source of transportation of agricultural products. In Kanadia village, animal farming was quite successful and number of implement/ha was 0.69 and 0.18 ha⁻¹ in 1st and 2nd survey. The percentage decrease in bullock drawn implements between 1st and 4th survey was 89, 76, 91 and 58 per cent for Singod, Phanda, Sonsa and Kanadia, respectively (Table 2). The population of tractor drawn implement increased to a great extent over the years, whereas comparatively higher number of bullock drawn implement existed during 1st survey. Similar trend results were reported by Singh et al. (2015).

Table 2 Change in availability of farm machinery in villages under study

| Village | Implement Category | 1992-93 | 2008-09 | Changes in Nos. of implements | Change (%) |
|---------|--------------------|---------|---------|-------------------------------|------------|
| | | Nos. | Nos. | | |
| Singod | Animal Drawn | 406 | 44 | -362 | -89% |
| | Tractor - Drawn | 25 | 43 | 18 | +72% |
| | Power Driven | 17 | 56 | 39 | +229% |
| Phanda | Animal Drawn | 426 | 102 | -324 | -76% |
| | Tractor - Drawn | 40 | 79 | 39 | +98% |
| | Power Driven | 28 | 63 | 35 | +125% |
| Sonsa | Animal Drawn | 543 | 49 | -494 | -91% |
| | Tractor - Drawn | 23 | 109 | 86 | +374% |
| | Power Driven | 39 | 71 | 32 | +82% |
| Kanadia | Animal Drawn | 1013 | 427 | -586 | -58% |
| | Tractor - Drawn | 28 | 162 | 134 | +479% |
| | Power Driven | 53 | 90 | 37 | +70% |

In village Singod, animal drawn implement usage reduced continuously in successive surveys. The most popular implement was local plough (Indigenous / iron

plough) followed by blade harrow (bakhar) and Nari plough in almost all the villages under study. Blade harrow was used for levelling and weeding. Seed drill

(Nari) is bullock drawn tillage implements attached with funnel for dropping the seeds behind the furrow opener. In the village Singod, broad casting or seed drilling (Nari) was common during 1992-93 whereas during 1999-2000

and thereafter separate seed drilling was popular. Figure 1 shows the changing scenario for the use of bullock drawn implements in village Singod.

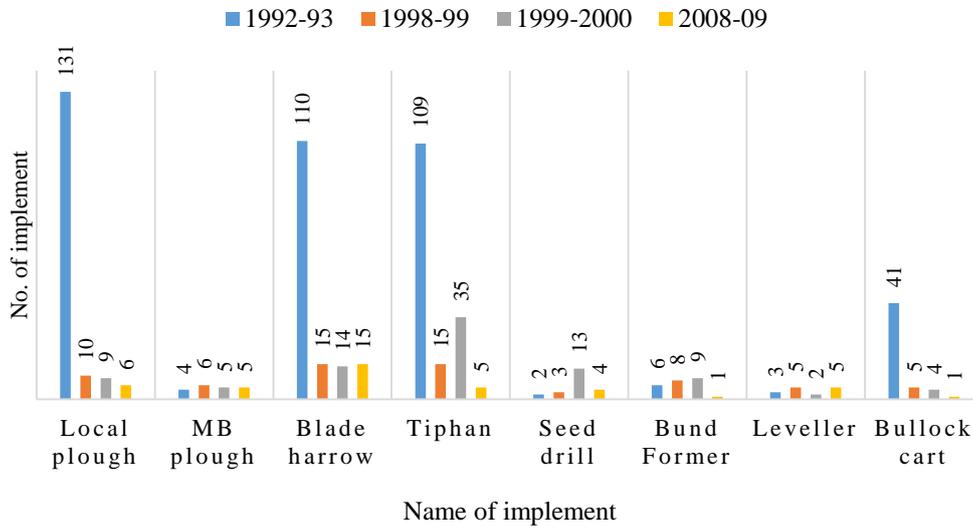


Figure 1 Changing scenario for use of bullock drawn Implements in village Singod

Figure 2 shows that most popular bullock drawn implements in Phanda were local plough, Nari, blade harrow Dora and bullock cart for tillage, sowing,

leveling, weeding, and transportation respectively during the first survey.

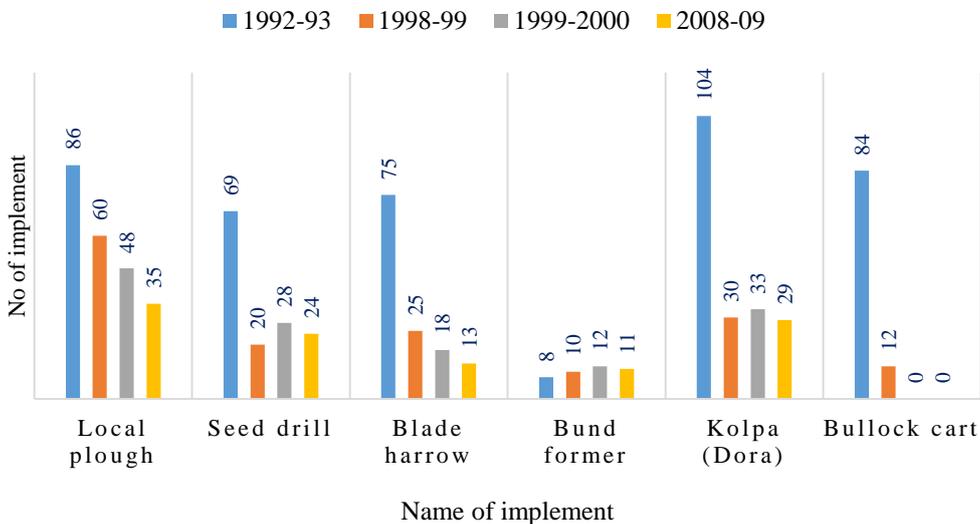


Figure 2 changing scenario for use of bullock drawn Implements in village Phanda

In village Sonsa, the smallest selected village as far as cultivable land was concerned possessed quite good number of bullock drawn implements as it can be seen in Figure 3. In place of Nari, the two types sowing device known as “Dufan” was very popular in this region. The local plough was mainly composed of iron plough. The soil of the region belongs to loamy soil showed that the required tilth level could be achieved quite easily in this

village as compared to other villages. The bund former could be useable to form the bund in the field. Blade harrow in this village was used as weeder whereas leveller (plank) was used for levelling. In other region, soil is heavy in nature, and the blade harrow were used for levelling.

Animal drawn implements regain its popularity in last round in the village Kanadia (Figure 4). It may be due to

the non-availability of tractor to the farmers who did not own it at the time of requirement which attracted the

farmers to return to bullock drawn implements which was available to them as and when required.

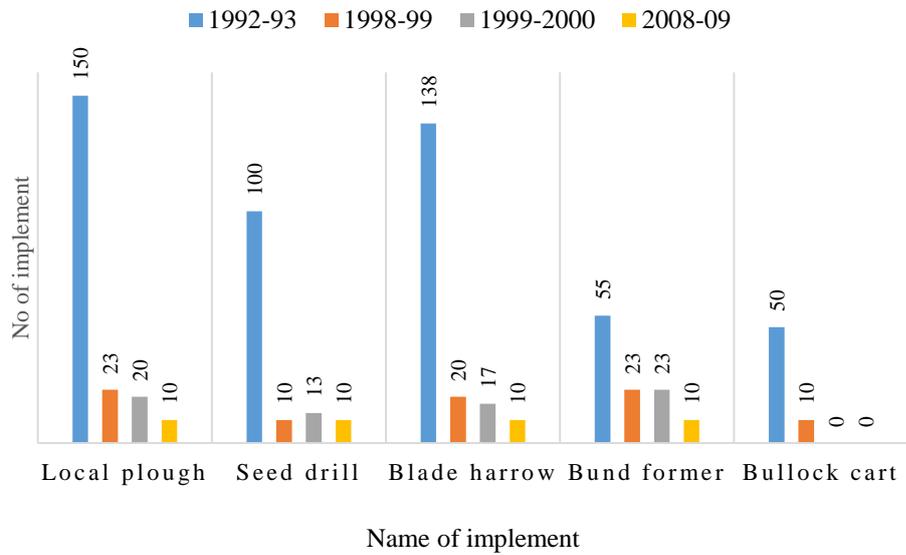


Figure 3 Changing scenario for use of bullock drawn Implements in village Sonsa

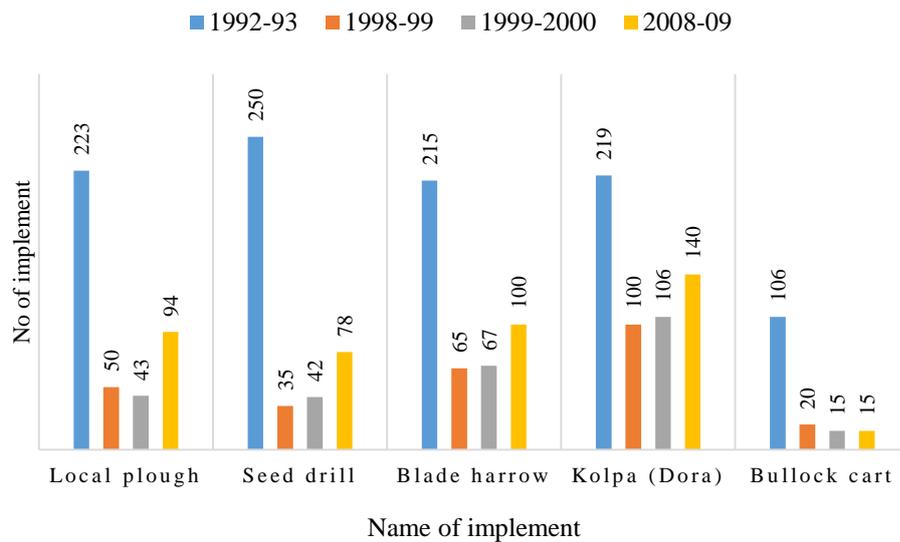


Figure 4 Changing scenario for use of bullock drawn Implements in village Kanadia

In all the villages, the number of farm implements are decreasing over the time. While interacting with the farmers, it was observed that the use of farm animals for field work in small farms was becoming unattractive for various reasons viz. high maintenance cost of draught animals, higher fodder cost, limited working capacity, drudgery and low interest of younger generation in traditional practices (Kahlon, 1981). Lacking of improved and user-friendly design of animal operated equipment was also a major issue and needed to be addressed (Ramaswamy, 1994; Singh, 1999). Mechanization helped to bring about a significant improvement in agricultural productivity but that results in lowering the usage of

draught animal for agriculture. The marginal and small farmers can be mechanised by the use of improved manual tools and animal drawn farm equipment on individual ownership basis so that the farm operation can be completed with minimum inputs and in a better and sustainable way.

4 Conclusions

It is quite evident that in study area there was continues reduction in number of draught animal and same pattern is followed in other parts of the country. There was a rapid declining of number of draught animals i.e., in range of 76.1% to 90.2%. This shows a trend of

farmer's preference of machine power over animal power. Present approaches in agriculture inclined towards more use of heavy machines like tractors, combine harvesters, etc. Draught animals are a cost-effective power source for small farmers and they minimize the financial risk of growing crops for farmers. The marginal and small farmers can use animal power to complete their farming operation in sustainable and better way. There is scope to improve work efficiency of traditional implements to get more output and increased efficiency without jeopardizing animal health.

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