Agriculture Update
Volume **12** | TECHSEAR-8 | 2017 | 2306-2313
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RESEARCH ARTICLE :

Present scenario of draught animal power utilization in Aurangabad district

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ARTICLE CHRONICLE :
Received :
20.07.2017;
Accepted :
16.08.2017

SUMMARY : The study was conducted in Aurangabad district of Marathwada region of Maharashtra state. On average 72.50 % farmer had their own Bullock pair for agricultural operation. All the farmers used bullock pair for their tillage operations and transportation. The study showed that farmers used draft animals for, ploughing, harrowing, Drilling, intercultural operation and transportation. 24.58% of the farmers used draft animals for ploughing, 46.25% for harrowing, 53.75% for Drilling, 60% for intercultural operation and 60.62% for transportation.

How to cite this article : Wagh, R.U., Patil, R.A., Thombre, B.M. and Padghan, P.V. (2017). Present scenario of draught animal power utilization in Aurangabad district. *Agric. Update*, **12** (TECHSEAR-8) : 2306-2313.

KEY WORDS :
Draft animal power, Agricultural operation, Draught animal intensity

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BACKGROUND AND OBJECTIVES

It is an important source of draught power, manure for crop production and fuel for domestic use. Thus, by minimizing use of non-renewable energy, livestock make a positive contribution to the economic development. Livestock sector is an important source of income for the farmers and rural poor people, in terms of milk production, draft energy and self employment. The growth in the livestock subsector is expected to contribute to poverty alleviation, as the livestock elements are largely concentrated among the marginal, small farmers and by the landless families.

It is estimated that 67 per cent of energy input in the farming enterprise comes from animal sources, 23 per cent from human exertion and remaining 10 per cent from fossils with regard to transportation and 66 per cent of goods are handled by bullock carts, and remaining by other media. These finding amply justify the importance of animal power in agriculture and transportation of goods in India.

Land holding of farmers is decreasing generation by generation due to the fragmentation of family. Indian agriculture is facing global warming, erratic nature of monsoon with decreasing rainy days, occurrence of frequent droughts, all these factors affects the crop production drastically. In Indian agriculture, crop production and livestock industry dependent to each other and remains inseparable. Livestock particularly draught animal power plays an important role to carry different agricultural operations due to which Zebu bullock pair is said to be a cheap

and chief source of energy in rural India. Though all these merits are with animal power but its utilization is decreasing day by day. Either some factor may be responsible for this scenario or some constraints may be there which farmers are facing in utilization of draught animal power (DAP). There are some points of curiosity for research study

Whatever developmental work took place in draught animal power (DAP) utilization, attitude of farmer towards draught animal play an important role in the efficient utilization of bullocks in farming practices. When the farmers have positive attitude towards the utilization of draught bullocks in agriculture, then only the actual utilization of the animals can be achieved. The use of DAP varies from one area to another depending on the historical background, farmers attitudes and incidence of livestock disease (Kumwenda 2000).

RESOURCES AND METHODS

The present study was conducted in Aurangaba ddistrict of Marathwada region of Maharashtra state. The multistage sampling technique was used to select district, tahsils, and village. There are total nine tahsils in Aurangabad district out of which four tahsils *i.e.*, Aurangabad as block 1, Paithan as block 2, Sillod as block 3 and Vaijapur as block 4 were selected purposively, from each tahsils five villages were selected. In each selected village 12 farmers were selected in different categories (land holding) of farmers *i.e.* Randomly 3 farmers from each category of (a) marginal (less than land 1 ha.), (b) small (between land 1-2 ha.), (c) medium (between land 2-4 ha.) and (d) large (more than land 4 ha.) categories of farmers. Thus, data of 240 farmers were collected and recorded by taking interview.

OBSERVATIONS AND ANALYSIS

In present study availability of bullock pair in various categories of farmers was assessed and data is presented in Table 1.

As per study only 31.67 per cent farmers from marginal categories had their own bullocks, while remaining small, medium and large categories of farmers possessed own bullocks as 73.33, 88.33 and 96.67 per cent, respectively. On an average about 72.50 per cent farmer had their own bullocks for agricultural operation in surveyed area.

It was found that 68.33, 26.67, 11.67 and 3.33 per cent marginal, small, medium and large categories of farmers, respectively did not own bullocks. Therefore, these farmers depend on custom hiring of either tractors or bullocks.

Saxena (1995) reported that utilization bullocks by owner household in Naman village of Gujarat state that out of the 15 bullock-owning sample households, there households did not use their bullocks for either their own work or for hiring out, they kept their bullocks for sale

Table 1: Status of bullocks in different categories of farmer

Cate. of farmer / Blocks	Marginal		Small		Medium		Large		Total	
	Possess bullocks	Have no bullocks	Possess Bullocks	Have no bullocks	Possess Bullocks	Have no bullocks	Possess bullocks	Have no bullocks	Possess bullocks	Have no bullocks
Block – I	04	11	13	02	13	02	14	01	44 (73.33)	16 (26.67)
Block-II	05	10	10	05	13	02	15	00	43 (71.67)	17 (28.33)
Block-III	06	09	10	05	14	01	15	00	45 (75.00)	15 (25.00)
Block-IV	04	11	11	04	13	02	14	01	42 (70.00)	18 (30.00)
Total	19 (31.67)	41 (68.33)	44 (73.33)	16 (26.67)	53 (88.33)	07 (11.67)	58 (96.67)	02 (3.33)	174 (72.50)	66 (27.50)

Note: n=60 for each category of farmer, Total N= 240, figures in parenthesis indicates the percentage to the total

Table 2: Draught animal intensity (ha/animal pair) in different categories of farmers

Categories / Block	Marginal	Small	Medium	Large	Average
B–I	0.85 ± 0.05 (04)	1.66 ± 0.07 (13)	3.13 ± 0.16 (13)	7.07 ± 0.80 (14)	3.18 ± 0.73 (44)
B-II	0.96 ± 0.02 (05)	1.68 ± 0.07 (10)	2.98 ± 0.16 (13)	5.99 ± 0.67 (15)	2.90 ± 0.59 (43)
B-III	0.76 ± 0.60 (06)	1.60 ± 0.09 (10)	2.81 ± 0.16 (14)	5.37 ± 0.45 (15)	2.64 ± 0.53 (45)
B-IV	0.90 ± 0.03 (04)	1.81 ± 0.06 (11)	2.95 ± 0.16 (13)	6.02 ± 1.09 (14)	2.92 ± 0.59 (42)
Mean	0.87 ± 0.02 (19)	1.69 ± 0.02 (44)	2.97 ± 0.03 (53)	6.11 ± 0.18 (58)	2.91 ±0.60 (174)

and met their requirement of bullock's power from the hired ones, of the remaining 12 bullocks owning sample households with their 17 bullocks.

Behera *et al.* (2006) studied selected villages of Orissa state and reported that about 87 to 90 per cent farmer of the surveyed villages owned bullocks where as 10-13 per cent farmers did not own bullocks and depends on custom hiring of tractors and bullocks. It was also observed that few farmers were having single bullocks and used them on sharing basis.

Draught animal intensity is defined as inverse of draught animal pair per unit net area *i.e.* average area to be cultivated by a pair of animal (ha/animal pair). This has been expressed to access the average availability of draught animal in different categories of farmer in present study and results are documented in Table 2.

Acreage per draught animal pair was highest in large farmer (6.11 ± 0.18 ha. per animal pair) followed by medium (2.97 ± 0.03ha. Per animal pair), small (1.69 ±0.02ha. per animal pair) and lowest in marginal farmers (0.87 ± 0.02ha. per animal pair).

To ensure timelines in field operations, usually 1.5-2.5 ha per animal pair is considered reasonable command area on net area basis (Singh, 1999). But the present findings were more than optimum average.

Acreage per draught animal pair in India was 3.67 ha /animal pair, whereas, in Maharashtra it was 5.10 ha per animal pair in 1992 (Singh, 1999). Therefore, in present investigation of Aurangabad district the acreage per draught animal pair (2.90 ± 0.60 ha/ animal pair) was low as compared to state and India level average. It might be due to fragmentation of land very fast since last two decades. Mali, (2014) also recorded similar observations in Latur district as draught animal intensity (ha/animal pair) in marginal, small, medium and large as 0.71 ± 0.05, 1.60± 0.03, 3.20 ± 0.07 and 6.27 ± 0.27 ha. per animal pair.

Singh, (1999) reported acreage per draught animal pair as 1.61, 2.93, 4.64, 7.89, 15.84 and 4.14 ha per animal pair in marginal,small, semi medium, medium, large and overall, respectively.

Singh *et al.*, (1992) studied that the similar trend with present investigation in selected village of Punjab as average area per pair of bullocks was 2.8 ha.

The data pertaining to the agricultural operations carried out by using different energy sources is presented

Table 3: Ploughing operations carried out by using different energy sources

	A) By own bullock pair					B) By tractor					C) By Bullock pair + Tractor				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	03	02	01	02	08	12	13	13	13	51	00	00	01	00	01
					(13.33)					(85.00)					(1.67)
B-II	04	06	01	01	12	11	09	13	13	46	00	00	01	01	02
					(20.00)					(76.67)					(3.33)
B-III	06	05	05	05	21	09	10	09	08	36	00	00	01	02	03
					(35.00)					(60.00)					(5.00)
B-IV	03	07	03	05	18	12	08	12	08	40	00	00	00	02	02
					(30.00)					(66.67)					(3.33)
Total	16	20	10	13	59	44	40	47	42	173	00	00	03	05	08
	(26.67)	(33.33)	(16.67)	(21.67)	(24.58)	(73.33)	(66.67)	(78.33)	(70.00)	(72.08)	(00)	(00)	(5.00)	(8.33)	(3.33)

Note: n=60 for each category of farmer, Total N= 240, figures in parenthesis indicates the percentage to the total, Number of respondents for bullock pair on hired basis is nil

Table 4: Status of tractor ownership in different categories of farmers

Categories	Marginal		Small		Medium		Large		Total	
Blocks	Possess tractor	Have no tractor	Possess tractor	Have no tractor	Possess tractor	Have no tractor	Possess tractor	Have no tractor	Possess tractor	Have no tractor
Block – I	02	13	02	13	01	14	02	13	07 (11.67)	53 (88.33)
Block-II	00	15	01	14	01	14	05	10	07 (11.67)	53 (88.33)
Block-III	00	15	02	13	03	12	05	10	10 (16.67)	50 (83.33)
Block-IV	00	15	01	14	01	14	06	09	08 (13.33)	52 (86.67)
Total	02 (3.33)	58 (96.67)	06 (10.00)	54 (90.00)	06 (10.00)	54 (90.00)	18 (30.00)	42 (70.00)	32 (13.33)	208 (86.67)

Note: n=60 for each category of farmer, Total N= 240, figures in parenthesis indicates the percentage to the total

in Table 3. It was clear that the marginal, small, medium and large categories of farmer utilized own bullocks for ploughing as 26.67, 33.33, 16.67 and 21.67 per cent, respectively. On an average 24.58 per cent of farmers conduct ploughing operation by using own bullocks. Number of farmer from marginal, small, medium and large categories of farmers utilized tractor for ploughing was 73.33, 66.67, 78.33 and 70.00 per cent, respectively. An average 72.08 per cent farmer used tractor power for ploughing operation. Not a single marginal and small farmer utilized tractor and bullock energy combine for ploughing. However, medium and large farmers used this combine source for ploughing as 5.00 and 8.33 per cent, respectively. An average 3.33 per cent farmer used tractor and bullock energy combine for ploughing operation.

Tyagi *et al.*, (2010) also observed similar trend that the contribution of tractor power was more compared to share of animal power in total power availability in India. The increasing trend of utilization of tractor energy in agricultural operation may be due to faster acceptability of tractor by the Indian farmers for various agricultural operations.

Tractor is a source of mechanical energy to agricultural farming. It was observed from Table 4that the marginal categories of farmers had 3.33 per cent own tractor and depends on custom hiring of tractors and bullock pair. The small, medium and large categories of farmers had as 10.00, 10.00 and 30.00 per cent own tractors, respectively. On average 13.33 per cent farmers had their own tractors for agricultural operations. This indicates that as holding of farmer increased the possession mechanized sources of energy increased to some extent.

The results of present study were parallel with observation reported by Mali (2014) and More (2014). Singh and Singh (1996) also observed that the share of mechanical power in Indian agriculture has increased to 78.70 per cent in 1995 from 2.70 per cent in 1950. The mechanical power was increased from 0.005 kW/ha to 0.6 kW/ha during same period.

From Table 5 it was clear that, most of the respondent (87.50 %)(were in the opinion that ploughing operation by tractor power required minimum time with better performance and giving Ist rank followed by ploughing with the help of bullock pairs require more time and cost, this reason quoted by 82.91 per cent respondents having IInd rank. Unavailability of sufficient bullock pair on hired basis for ploughing operation, this reason was opined by 57.50 per cent respondent *i.e.* IIIrd rank. Whereas respondents were opined percentage regarding the unavailability and negative mentality of labour for ploughing operation with help of bullock pair as 52.91 per cent. About 52.08 per cent respondent opined that maintenance of 2-3 bullock pair throughout year is not practically possible. Whereas last rank given by respondent farmers to tractor and tractor drawn implements are easily available *i.e.* 37.92 per cent.

Ploughing operation was of hard and heavy work which requires more energy and it was not possible to do with available animal energy and if available, it requires more time and cost / throughout year. Not only maintenance 2 to 3 bullock pair was practically impossible but also availability of bullock pair on hired basis for ploughing was another obstacle. Labour unavailability to

Table 5: Probable reasons for use of tractor power for ploughing operation

Sr. No.	Possible reasons	Marginal (n=60)	Small (n=60)	Medium (n=60)	Large (n=60)	Total (N=240)	Rank
1.	Maintenance of 2-3 bullock pair throughout year is not practically possible	55 (91.67)	50 (83.33)	15 (25.00)	05 (8.33)	125 (52.08)	V
2.	Unavailability of sufficient bullock pair on hired basis for ploughing operation	35 (58.33)	40 (66.67)	35 (58.33)	28 (46.67)	138 (57.50)	III
3.	Unavailability and negative mentality of labour for ploughing operation with help of bullock pair	16 (26.67)	30 (50.00)	46 (76.67)	35 (58.33)	127 (52.91)	IV
4.	For ploughing with the help of bullock pairs, require more time and cost	56 (93.33)	52 (86.67)	49 (81.67)	42 (70.00)	199 (82.91)	II
5.	Ploughing and preparatory tillage operation with tractor power required minimum time with better performance	57 (95.00)	52 (86.67)	51 (85.00)	50 (83.33)	210 (87.50)	I
6.	Tractors and tractor drawn implements are easily available	20 (33.33)	15 (25.00)	18 (30.00)	38 (83.33)	91 (37.92)	VI

Figures in the parenthesis indicates the percentage of the total

do heavy work was also an issue facing to the respondents. As against above facts by ploughing and preparatory tillage operation carried out by tractor power lead to timeliness with better efficiency and non dependency on labour factor.

It can seen from Table 6that the harrowing operation carried using own bullock energy by different categories of farmer as 30.00, 58.33, 58.33 and 38.33 per cent in marginal, small, medium and large farmer, respectively. Highest bullock energy for harrowing utilized in by small and medium farmer followed by large farmer where as lowest in marginal farmer. The overall percentage of utilization of own bullock energy by farmers for harrowing operation was 55.50 per cent.Hired bullock energy utilized for harrowing operation by marginal farmer was 35.00 per cent, small farmer 16.67 per cent, medium farmer 8.33 per cent and large farmer was 5.00 per cent. The overall percentage of utilization of Hired bullock energy by farmers for harrowing operation was 16.25 per cent.

In surveyed area it was found that about 31.67 per cent marginal farmer, 20.00per cent small farmer, 20.00 per cent medium farmer and 28.33 per cent large categories of farmers utilized mechanization for agricultural operations. Farmers utilized both bullock pair and tractor energy for harrowing operation *i.e.* 3.33 per cent marginal, 5.00 per cent small, 13.33 per cent medium and 28.33 per cent large farmers. Overall 12.50 per cent farmers utilized both bullocks and tractor energy for harrowing operation. The result indicates that still draught animal power energy is major source in agricultural operations.

These results are supportive to the observation by Mali (2014) and More (2014). Ulmek (2012) reported that the use of mechanical power in agriculture has increased but draught animal power (DAP) continuous to be used an Indian farms due to small holdings and hill agriculture, more than 55.00 per cent of the total cultivable area is still being managed by using draught animal as against about 20.00 per cent by tractor.

In present study data regarding utilization of different energy sources is presented in Table 7. Majority of farmers carried out drilling operations by using bullock energy either own bullocks or by hiring bullocks. By using own bullock's energy in drilling operations carried by marginal, small, medium and large as 31.67, 61.67 66.67 and 55.00 per cent, respectively. The overall percentage of utilization of bullock energy by farmer for drilling operation was 53.75per cent. Whereas by hiring bullock pair the percentage of farmers was 65.00,25.00,13.33 and 6.67per cent in marginal, small, medium and large farmer, respectively. The overall percentage of utilization of hired bullock energy by farmer for drilling operation was 27.50per cent.

By using tractor energy for drilling operations for marginal, small, medium and large categories of farmer was 3.33, 10.00, 10.00 and 26.67per cent, respectively. Combine bullock and tractor energy utilized by farmers was 3.33per cent in small, 10.00per cent in medium and 11.67 per cent in large farmer. None of the marginalcategory farmer utilized both combine bullock and tractor energy for drilling operations. Overall 6.25 per cent farmer's utilized bullock as well as tractor energy

Table 6: Harrowing operation carried out by using different energy sources

	A) By own bullock pair					B) By hired bullock pair				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	03	08	08	04	23 (38.33)	05	03	02	02	12 (20.00)
B-II	05	09	08	05	27 (45.00)	05	02	00	00	07 (11.67)
B-III	06	09	08	08	31 (51.67)	05	02	02	00	09 (15.00)
B-IV	04	09	11	06	30 (50.00)	06	03	01	01	11 (18.33)
Total	18 (30.00)	35 (58.33)	35 (58.33)	23 (38.33)	111 (55.50)	21 (35.00)	10 (16.67)	05 (8.33)	03 (5.00)	39 (16.25)

	C) By tractor					D) By bullock + Tractor				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	07	03	03	04	17 (28.33)	00	01	02	05	08 (13.33)
B-II	05	04	04	05	18 (30.00)	00	00	03	05	08 (13.33)
B-III	02	03	03	03	11 (18.33)	02	01	02	04	09 (15.00)
B-IV	05	02	02	05	14 (23.33)	00	01	01	03	05 (8.33)
Total	19 (31.67)	12 (20.00)	12 (20.00)	17 (28.33)	60 (25.00)	02 (3.33)	03 (5.00)	08 (13.33)	17 (28.33)	30 (12.50)

Note: n=60 for each category of farmer, Total N= 240, figures in parenthesis indicates the percentage to the total

for drilling operations.

Mali (2014) and More (2014) also observed more or less similar trend regarding the utilization of different energy sources for drilling operation in Latur and Parbhani district,respectively.

The data regarding in such operations is presented in Table 8. It was observed that only 31.67 per cent of marginal categories farmers conduct intercultural operations by using their own bullock energy. Whereas small category contribute 63.33 per cent, medium 78.33per cent and large category 66.67 per cent. The overall intercultural operation carried out by using own bullock energy was 60.00 per cent.

It could be inferred from the studies that 65.00 per cent marginal farmer carried intercultural operation by using hired bullock energy, small category respondents 26.67 per cent, medium category 11.67 per cent and large category 3.33 per cent, respectively. An average about 26.67 per cent of respondents completed the intercultural operation by using hired bullockenergy. None of the respondent had carried their intercultural operation by soley using tractor energy.

In case of both bullock pair and tractor energy, 3.33 per cent of respondents of marginal categories were used this combine energy, while remaining small, mediumand large categories farmer was 10.00,10.00 and 30.00 per cent, respectively. The overall percentage of utilization ofboth bullock pair and tractor energy by farmer for intercultural operation was 13.33per cent.

Similar results were reported by Mali (2014) and More (2014) for intercultural operation carried out by using different energy sources. Sexena (1995) reported that most of the sample farmers in Naman village of Gujarat utilized bullock power only for intercultural

Table 7 : Drilling operation carried out by using different energy sources

	A) By own bullock pair					B) By Hired bullock pair				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	04	09	09	08	30 (50.00)	09	04	03	03	19 (31.67)
B-II	05	08	11	08	32 (53.33)	10	05	02	00	17 (28.33)
B-III	06	10	10	09	35 (58.33)	09	02	00	01	12 (20.00)
12	04	10	10	08	32 (53.33)	11	04	03	00	18 (30.00)
Total	19 (31.67)	37 (61.67)	40 (66.67)	33 (55.00)	129 (53.75)	39 (65.00)	15 (25.00)	08 (13.33)	04 (6.67)	66 (27.50)

	C) By tractor					D) By Bullock + Tractor				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	02	02	01	02	07 (11.67)	00	00	02	02	04 (6.67)
B-II	00	01	01	05	07 (11.67)	00	01	01	02	04 (6.67)
B-III	00	02	03	04	09 (15.00)	00	01	02	01	04 (6.67)
B-IV	00	01	01	05	07 (11.67)	00	00	01	02	03 (5.00)
Total	02 (3.33)	06 (10.00)	06 (10.00)	16 (26.67)	30 (12.50)	00 (0.00)	02 (3.33)	06 (10.00)	07 (11.67)	15 (6.25)

Table 8: Intercultural operation carried out by using different energy sources

	A) By own bullock pair					B) By hired bullock pair					C) By Bullock pair + Tractor				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	04	11	12	12	39	09	02	02	01	14	02	02	01	02	07
					(65.00)					(23.33)					(11.67)
B-II	05	09	12	10	36	10	05	02	00	17	00	01	01	05	07
					(60.00)					(28.33)					(11.67)
B-III	06	08	11	10	35	09	05	01	00	15	00	02	03	05	10
					(58.33)					(25.00)					(16.67)
B-IV	04	10	12	08	34	11	04	02	01	18	00	01	01	06	08
					(56.67)					(30.00)					(13.33)
Total	19	38	47	40	144	39	16	07	02	64	02	06	06	18	32
	(31.67)	(63.33)	(78.33)	(66.67)	(60.00)	(65.00)	(26.67)	(11.67)	(3.33)	(26.67)	(3.33)	(10.0)	(10.00)	(30.0)	(13.33)

Note: n=60 for each category of farmer, Total N= 240, figures in parenthesis indicates the percentage to the total, Number of respondents using only tractor is nil

operations in various crops.

Table 9 reveled that transportation carried with the help of own bullock energy *i.e.* other than tractor, the marginal category contributes 31.67 per cent while remaining category respondents used own bullocks as a source of transportation and their distribution was 63.33 per cent small category, 80.00 per cent medium category and 66.67 per cent large category. Commonly use of bullock energy for transportation in surveyed area was about 60.42 per cent.

It was observed that the 56.67 per cent of respondents from marginal categories carried transportation operation by using hired bullocks while remaining small and medium categories respondents used hired bullocks as a source of transportation and their percentage was 20.00 and 10.00 per cent, whereas, large categories farmers was 3.33 per cent. On average about 22.50 per cent of respondents used hired bullock energy for transportation.

For transportation prominently marginal and medium categories farmers were used tractors was 11.67 and 11.67 per cent, respectively. Medium and large categories respondents were used solely tractor energy to carry the transportation and their percentage was 1.67 and 18.33per cent, respectively. On average about 10.83 per cent of farmers were depend solely on tractors to carry the transport. Some of the respondents from surveyed area used both the bullocks and tractors energy as a source of transportation and their percentages varies as, small 5.00, medium 8.33 per cent and large categories farmers was 11.67 per cent, respectively. None of farmer from marginal categories farmer used this combine bullocks and tractors energy as a source of transportation. On average about 6.25 per cent of farmers was depending on both the bullocks and tractors energy as a source of transportation. Similar observations were reported by Mali (2014) and More (2014).

Conclusion :

The status of bullock pair ownership is declining particularly in marginal and small farmers due to fragmentation of land holding and slowly it is making towards medium and large farmers group.

Mechanical energy was accepted for hard and heavy tillage operations instead of animal energy where as drilling and intercultural operations were still carried out by animal energy though they were time consuming. In spite of unavailability of better road approach to the field in rural area farmers relied on animal energy for transportation.

Due to approach of mechanical energy up to same extent the animal energy use is
substantially decreased particularly in medium and large farmers.

Draught animal and agricultural worker may remain the chief source of farm power for soil manipulation and crop handling; mechanical power for tillage, irrigation, harvesting and threshing will be preferred including custom hiring by farmer who cannot afford to own machines.

Table 9 : Transportation of farm produce carried out by using different energy sources

	A) By own bullock pair					B) By Hired bullock pair				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	04	11	12	12	39 (65.00)	09	02	02	01	14 (23.33)
B-II	05	09	13	10	37 (61.67)	08	03	01	00	12 (20.00)
B-III	06	08	11	10	35 (58.33)	09	05	01	00	15 (25.00)
B-IV	04	10	12	08	34 (56.67)	08	02	02	01	13 (21.67)
Total	19 (31.67)	38 (63.33)	48 (80.00)	40 (66.67)	145 (60.42)	34 (56.67)	12 (20.00)	06 (10.00)	02 (3.33)	54 (22.50)

	C) By tractor					D) By Bullock + Tractor				
Block	Marginal	Small	Medium	Large	Total	Marginal	Small	Medium	Large	Total
B-I	02	02	01	02	07 (11.67)	00	00	00	00	00 (00)
B-II	02	03	00	05	10 (16.67)	00	00	01	00	01 (1.67)
B-III	00	00	00	02	02 (3.33)	00	02	03	03	08 (13.33)
B-IV	03	02	00	02	07 (11.67)	00	01	01	04	06 (10.00)
Total	07 (11.67)	07 (11.67)	01 (1.67)	11 (18.33)	26 (10.83)	00 (00.00)	03 (5.00)	05 (8.33)	07 (11.67)	15 (6.25)

Note: n=60 for each category of farmer, Total N= 240, figures in parenthesis indicates the percentage to the totals.

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