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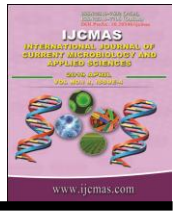

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Status and Prospects of Farm power in Godhra Taluka of Panchmahal District, India

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A B S T R A C T

Availability of adequate farm power is very crucial for timely farm operations for increasing production and productivity and handling the crop produce to reduce losses along with enhancing the economic status of the farmers. Thus, it is essential to estimate the farm power requirement so that future strategies may be formulated accordingly. Considering, this study was conducted for Godhra taluka of Panchmahal district by collecting data from secondary sources regarding land holding pattern, animal census, farm power implements used and area under different crops. Data was investigated and concluded that lower hp tractors are preferable in the region as more than 90% tractors were less than 50 hp while power tillers of more than 10 hp are popular. Diesel engines and electric pumps of less than 10 hp have more acceptances. The average land holding size of the taluka is decreasing day by day. It decreased from 2.12 ha to 1.36 ha during 1995-96 to 2005-06. Tractor drawn implements are increasing day by day while manual operated implements are decreasing. Available animal power is decreasing while mechanical power is increasing. Thus, the shift is towards use of mechanical power. In future demand of mini tractors or power tillers will be more as compared to other farm power sources due to continuous decrease in land holding size.

Introduction

Agriculture plays a vital role in Indian economy. To enhance the income from agriculture, it is essential to increase the productivity or brought more land under cultivation, which is limited. Mechanization of field operations (tillage, sowing, irrigation, intercultural operations, harvesting, threshing etc.) is one way to increase productivity as agriculture machinery and implements are capable of doing field operations with precision and in lesser time. Use of farm machineries requires some power source (manual, animal or mechanical) at the farm. Traditionally humans and draft animals met this need. However, for the current level of intensity of farming, required levels of productivity, with a work environment required cannot be met by animate sources

alone. As a result electro-mechanical sources supplement and substitute animate sources. Thus, farm power is an essential input in agriculture for timely field operations for operating different types of farm equipment and for stationary jobs like operating irrigation equipment, threshers, shellers, cleaners, graders and other post-harvest equipment.

Availability of adequate farm power is very crucial for timely farm operations for increasing production and productivity and handling the crop produce to reduce losses. With the increase in intensity of cropping the turnaround time is drastically reduced and it is not possible to harvest and thresh the standing crop, on one hand, and prepare seed bed and do timely sowing operations of subsequent crop, on the other hand, in the limited time available, unless adequate farm power is available. The power-productivity relationship shows that higher farm power availability/ha has higher productivity. The average farm power availability in India has increased from about 0.25 kW/ha in 1951 to about 1.65 kW/ha in 2001 (Srivastava, 2004). Over the years the shift has been towards the use of mechanical and electrical sources of power, While in 1951 about 97.4% farm power was coming from animate sources, in 2001 the contribution of animate sources of power reduced to about 18% and that of mechanical and electrical sources of power increased from 2.6% in 1951 to about 82% in 2001. Considering the present trend, it is envisaged that by 2020 the average farm power need in India will be about 2 kW/ha of which the share of animate source will be only about 5% and that of mechanical and electrical power will be about 70% and 25% respectively. To meet this, India is yearly producing more than 2.5 lakh tractors, 10,000 power tillers, 10 lakh pumping sets, 2000 combine harvester. At present, agricultural machinery population in India is estimated at about 150 million which includes about 3 million tractor and other self-propelled equipment. Gujarat, having maximum agricultural growth rate in country, is still far behind in farm power availability (0.8 kW/ha) compared to the national average (1.35 kW/ha). Panchmahal, an agriculture dominated district of the state, is one of the most backward district due to low income from agriculture. Being a tribal dominated area, Godhra taluka of Panchmahal, have more pity condition. The agricultural productivity in this region is very less. One reason for this may be the use of traditional methods for growing crops and no or less use of farm machineries. To uplift the economic status and overall development of the area, it is essential to increase the productivity of this area by way of farm mechanization. To accomplish this, estimation of farm power requirement needs to be assessed for farming operations involved in different agricultural activities. Keeping this in mind, a study was planned to evaluate the current status of farm power in the region along with its future prospects.

Materials and Methods

This study was conducted to assess the present status of farm power and future prospects of farm power requirement in the Godhra taluka of Panchmahal district. To know the status of farm power information regarding agricultural machines and farm power being used was required. Data related to crops grown, land holding patterns, irrigated area, change in bullock population, implement used, etc. was required to explore the future demand of farm power. Thus, the required data of Godhra taluka was collected as per below:

General information of Godhra Taluka

Panchmahal is one of the most backward districts of Gujarat state. It is situated at 73.15º to 74.03º East (Longitude) and 20.34º

to 23.30º. It constituted of 11 talukas and 670 Panchayats. Godhra is one the taluka which is tribal dominated and consists of 97 Panchayats. It consists of 116 villages and one city. It is situated at 73.45º East (Longitude) and 22.42º North (Latitude). The location of Godhra taluka in Panchmahal district is shown in below figure 1. As per the geographical data, the area of Godhra taluka, total population and population per km^2 area are 759.72 km^2, 393663 persons and 518 km^2respectively. In this region farmers are taking crops of maize, paddy, bajra, pulses, cotton etc. with two to three crops annually. The soil of the region is sandy loam type in nature of soil in this area. The average rainfall during last 10 years has been more than 700 mm while the average rainfall in Godhra taluka was 459 mm during 2010-11.The general weather conditions are conducive to good agriculture harvest. The selected field location falls under semi-arid tropic having highest temperature of 45ºC recorded in the month of May and the lowest temperature of 14ºC during December. The land utilization pattern of the taluka is given in below table 1.

Secondary data collection

The required data were collected from the secondary sources i.e. District Panchayat Office. In this regard, related office was contacted and Statistical data of the district for year 2003-04, 2004-05, 2005-06 and 2010-11were collected regarding the crops grown, land holding classification, bullocks population, draught animals population, agricultural implements operated manually, animal power and by mechanical power, number of tractors, power tillers, engines, etc. Also, in this respect data of year 2003 and 2007 of 109 villages out of 116 villages of Godhra taluka were collected.

Land holding pattern

To assess the land holding pattern of the Godhra taluka, farmers were categorized as marginal, small, semi medium, medium and large farmers based on the land holding size and data according to this was collected.

Area under different crops

Maize, Paddy, pulses and Cotton are 4 main Kharif Crops grown over an area. Maize is the main crop covering 50% of area under Kharif crop. Wheat is the main Rabi crop covering 63% of area under Rabi crops. The soil in Godhra taluka in general is neutral pH. Electricity conductivity is low. Organic carbon is low and Phosphorus content of the soil is high. Potash is high. So, overall, the soil fertility indices are good from the point of view of agriculture. The cropwise data of area under cultivation was collected.

Farm power sources

The sources of power available on the farm could be broadly classified under mobile and stationary power. The brief details of the power sources are as under:

Mobile power

The sources of power which are used for mobile work may be categorized as:

1. Human (men, women, children)
2. Draught animals (bullocks, buffaloes, camels, horses and donkeys)
3. Tractors
4. Power tillers
5. Self-propelled machines (combines, dozers, reapers, sprayers etc.)

1. Human power

The costliest and inevitable source of farm power is human power. It can perform all the agricultural operations. But, there efficiency is very less. The agricultural workers are engaged in different farm operations and

depend on agriculture for their livelihood, even when they are not fully employed throughout the year. Due to labour in different farm operations, the cost of production in our country is quite high as compared to developed countries. The population of agricultural workers as percentage of rural population is decreasing day by day. Replacement of human power by other means is impossible.

2. Draught animal power

Draught animals are still the predominant source of mobile power. In general, bullocks, buffaloes, camels, horses and ponies, mules and donkeys are use for draught animal power but most of bullock is used as draught animal. They are very versatile and dependable source of power and are used in sun and rain under muddy and rough field conditions. They are ideal for rural transport where proper roads are not available. They reduce dependence on mechanical sources of power and save scarce petroleum products. Their dung and urine are also used as indirect source of energy-farmyard manure, biogas. Over the years the annual use of draught animals is going down.

3. Tractors

The demand of tractors that has been increasing steadily has helped in providing additional mobile power on the farm for timely farm operations and has helped in increasing agricultural production and productivity.

4. Power tiller

Their introduction coincided with that of agricultural tractors which were more suitable for upland work and provided more comfortable work environment to the operators. The walk-behind power tillers, on the other hand, created dusty environment for the operator. Secondly, the power tillers in dry land conditions were tiresome which resulted in longer rest periods, and consequently affected the work output.

5. Self-propelled machines

Many agricultural machines for specific work have their own source of power. These are called self-propelled machines. Day by day, number of machines manufactured for specific purposes is increasing. Some of the popular self-propelled machine are combines, dozers, reapers, sprayers, etc.

Stationary power

The power sources which are used for stationary works, come under this.

1. Diesel/oil engines (for pump sets, threshers, sprayers and other stationary operations)

2. Electric motors (for pump sets, threshers, sprayers and other stationary operations)

Electric Motors and Diesel Engines are the primary sources of stationary power. Stationary power sources in agriculture comprise of diesel engines and electric motors used for irrigation equipment, operating threshers, various post-harvest agro-processing operations and other stationary machines. The studies on operational efficiency of irrigation pumps have shown the efficiency of electric motor operated pumps to be 31.1% against only 12.7% of diesel engine operated pumps. Initially two-thirds were engine operated and one-third electric operated. As rural electrification advanced, proportions have changed in favour of electrical power.

Agricultural machines used

To perform the different field operations various machines/tools are used. The machines may be broadly classified as:

1. Manual operated machines/tools
2. Animal drawn implements
3. Mechanical power operated implements

1. Manual operated machines/tools

To perform the agricultural operations manually these implements are being used. These are small in size, light in weight, require less power and low field capacity. These may be further classified as walking type or sitting type. Examples of the manual implements are spade, hand hoe, wheel hoe, khurpa, seed drill, sickle, knapsack sprayer, etc.

2. Animal drawn implements

Many implements such as indigenous plough, disc harrow, cultivator, seed drill, weeders, etc. are being used to be operated by animal power. The main disadvantage of animal power is that animals need to be fed for 365 days of the year. Since draft animals consume considerable volumes of fodder, a significant proportion of the available land can be absorbed simply to support the draft animals. Therefore it probably would be difficult to justify the use of animals for irrigation pumping alone, but generally there are other economic applications for them, such as transport, tillage, and post-harvest duties like threshing or milling which allows them to be employed more fully than if they were used exclusively for irrigation. In India and other countries where animal powered water lifting is widely practiced, it is normal for the same animals to be used for transport and for tilling the land.

3. Mechanical power operated implements

Mechanical power includes tractor, power tillers, oil engines, self-propelled combines etc. in which oil is good device for converting fuel in to useful work. For meeting the increased demand of mobile power for timely farm operations and increased intensity of cropping, additional power is available mainly from tractors and power tillers.

Now a day's self-propelled reapers and combines also provide mobile power specially for harvesting operations.

Results and Discussion

Secondary data of Godhra taluka regarding the farm power and implements availability along with land holding distribution were collected and examined to assess the current status of farm power along with future prospects of farm power in the study area. The result of the study is divided into two parts, status and future prospects of farm power.

Present status of farm power in Godhra taluka

To evaluate the farm power status of study area, the collected data were interpreted as farm power source wise:

Manual power

Human power was used to play a vital role in agricultural operations for less power requiring works. The exact data of farm labour employed was not available and very difficult to obtain as farm labours are not employed throughout the year and also the exact quantification of time consumed by the farmers on their own land is difficult.

Although, the rural population for Godhra taluka was available this may be used to get the information of manual farm power availability. According to 2001 census rural population was 262,491 with 135,642 males and 126,849 females.

Animal power

The bullocks were main source of animal power in the taluka. The total numbers of bullocks available in the year 2007 were 28,215 which varied among villages.

Bullocks population was less than 100 in 21.1 % villages while more than 69.73% villages had bullocks population less than 500 in the year 2007. The percentage distribution of the bullocks in different villages of Godhra is given in Table 2.

Mechanical power

Tractors, power tillers and diesel engines were main source of mechanical power. More than 90% tractors were below 50 hp. Total tractor population was 535, out of only 23 were above 50 hp.

The power tiller population was 30 only out of which 23 were of more than 10 hp and rest was below 10 hp. In case of diesel engines low hp engines were more popular than higher hp tractors.

Total no. of diesel engines available were 6309. 6189 engines were upto 10 hp while others were above 10 hp.

Electrical power

Electric pumps were the main source of electrical power mainly used for irrigation purposes. More than 90 % pumps were upto 10 hp out of 702 pumps.

Future prospects of farm power in Godhra taluka

To explore the prospects of farm power in the study area farm power and implements availability data of year 2003 and 2007 were compared. Also, to assess the cropping and land utilization pattern were examined.

Land holding pattern

The average land holding size of the taluka decreased from 2.12 ha to 1.36 ha during 1995-96 to 2005-06. Small and marginal farmers owned 62.32% and 28.44% area and 73.45% and 34.05% land holding during the reported period, respectively. The trend of land holding size reduction is also expected to be followed in future, which will ultimately result into low power requirement per land holding (Fig. 2).

Area under different crops

In below table 3 about the area under different crops during the year 2002-05 in the Godhra taluka shows that area under cereal crops increased during 2002-03 to 2004-05. This indicates that more emphasis on grain crops which may be due to more use of agriculture implements for the intensive crop production (Table 4).

Agricultural implements under operations

To know the future power requirement it is necessary to know the trends of farm implements use in different agricultural operations. The farm implements had been divided into manual, animal drawn and mechanical power operated. The numbers of implements used in year 2003 and 2007 are shown in following Tables 5–8. All the manual operated implements decreased over the years while some animal drawn implements decreased and some increased (Below figures 3 and 4). The use of cultivator, fertilizer cum seed drill and puddler increased during 2003 to 2007, while use of tillage implements-plough, disc harrow, leveler decreased (Below figure 5). But, in case of tractor drawn implements trend was towards more use of tractor power. This is indicated by the increase in numbers of all the tractor operated implements. The increase was more

than 5 times in case of cultivators among tillage implements while maximum growth was in case of a thresher which was more than 16 times.

Animal power

The number of draught animals he buffalo, horse, camel and donkey increased during the year 2003 to 2007 while only bullocks population decreased from 31,845 to 28,215 (Below table). Accept bullocks other animals, now a days are not used on farms. They are generally used for transportation purposes in agriculture related works. The figure 6 indicates towards the decrease in animal power over the period and this trend seems to be continued in future.

Mechanical power

There was an increase in mechanical powers-tractors, power tillers and diesel engines from 2003 to 2007. Total no. of tractor and power tillers population were increased 28.30% and 30.43% from 2003 to 2007, respectively (below table).

The variation in numbers of mechanical powers is shown in below figures 5 and 7. The increase in above 50 hp tractors was more than upto 50 hp tractors. The no. of diesel engines of upto 10 hp and above 10 hp increased more during years 2003 to 2007. The increase in numbers of all mechanical sources indicates the more use of mechanical power in the future.

Table.1 Land use pattern of Godhra Taluka

Sr. No	Description	Area (ha)	% of total area
1	Total Land use	69586	-
2	Forest Land	15981	23.47
3	Waste and Non Cultivable Land	1254	1.30
4	Urban Land	7190	10.33
5	Cultivable Land	769	1.11
6	Land for Animal Fodder	1014	1.46
7	Running Waste Land	704	0.92
8	Net Cultivable/ Cropping Area	42674	61.43
9	Multi Cropping Area	669	1.29
10	Total Net and Multi Cropping Area	43343	62.71
Total Area		**69586**	

Source: Agriculture Department, Gandhinagar

Table.2 Bullocks available in different villages of Godhra taluka

Sr.No.	Range	% of total villages	
		2003	**2007**
1	0-100	13.51	21.10
2	100-300	27.03	29.36
3	300-500	20.72	19.27
4	500-1000	27.03	22.02
5	Above 1000	11.71	8.26

Source: Animal census, Godhra

Table.3 Average land holding in Godhra taluka during 1995-96* & 2005-06**

Farmer classification	Land holding size, ha	Number of land holdings		Area (ha)	
		1995-96	2005-06	1995-96	2005-06
Marginal	< 1	10052 (33.68)	15999 (49.77)	5315 (8.5)	5850 (11.79)
Small	1 – 2	8550 (28.65)	7610 (23.68)	12474 (19.94)	11041 (22.26)
Large	>2	11245 (37.68)	8534 (26.55)	44768 (71.56)	32715 (65.95)
Average land holding size, ha				**2.12**	**1.36**

Figures in parenthesis represents the % of total.
Source: District Statistical Figures, 2006-07* & 2010-11**

Table.4 Area under different crops in Godhra taluka during different years

Sr. No.	Name of Crops	Area Covered (ha) during the year		
		2002-03	2003-04	2004-05
1	Paddy	11065	11662	11820
2	Wheat	253	282	310
3	Jau	4	5	3
4	Kharif jawar	180	142	165
5	Rabi jawar	22	82	50
6	Bajara	2254	1782	1843
7	Maize	17347	18445	20140
8	Ragi bavto	182	145	160
9	Other grains	432	137	223
10	Gram	69	62	14
11	Green gram	62	54	60
12	Tuver	4758	4512	4624
13	Black gram	1129	1032	987
14	Other pulses	60	21	86
15	Sugarcane	5	7	11
16	Chilly	220	219	240
17	Ginger	15	0	3
18	Cumin	16	5	6
19	Garlic	6	0	0
20	Total fruits	163	172	178
21	Other vegetable	137	188	145
22	Cotton	1111	1362	600
23	Ground nut	197	405	240
24	Til	268	235	244
25	Rai	1	9	14
26	Other oil crops	22	14	12
27	Caster	472	447	520
28	Tobacco	1446	1254	987
29	Other fodder crops	1271	1764	1198

Table.5 Year wise availability of manual and animal drawn Implement

Sr. No.	Name of implements	Numbers during year	
		2003	2007
1	Fertilizer cum seed drill (manual)	7126	6906
2	Intercultural implement (manual)	1619	1533
3	Paddy planter (manual)	818	748
4	Thresher (manual)	80	62
5	Windrower (manual)	972	781
6	Wood plough	23655	14021
7	Iron plough	3968	3717
8	Cultivator	1797	2024
9	Disc harrow	2079	1933
10	Fertilizer cum seed drill	6382	6922
11	Leveler	6443	6381
12	Puddler	3991	4019
13	Sugar cane crusher	4	4
14	Cart	1026	1036
15	Oil mill	1	1

Source: Agriculture Department, Gandhinagar

Table.6 Year wise availability of tractor drawn impalements in Godhra taluka

Sr. No.	Name of Implement	Numbers during year	
		2003	2007
1	Cage wheel (mini tractor)	16	16
2	Reversible M.B. plough	7	16
3	Cultivator	86	433
4	Disc harrow	28	32
5	Rotavator	0	1
6	Fertilizer cum seed drill	33	43
7	Planter	3	4
8	Leveler	80	126
9	Potato digger	5	5
10	Trailer	518	537
11	Thresher	12	199

Source: Agriculture Department, Gandhinagar

Table.7 Year wise availability of draught animals in Godhra taluka

Sr No.	Draught animal	No. of animals	
		2003	2007
1	Bullocks	51845	28215
2	He Buffalo	635	10651
3	Horse	24	71
4	Camel	67	0
5	Donkey	414	734

Source: Animal Census, Godhra

Table.8 Year wise availability of mechanical power sources in Godhra taluka

Power source	Range	Numbers during year	
		2003	2007
Tractor	Up to 50 hp	403	512
	Above 50 hp	14	23
Power tiller	Up to 10 hp	3	7
	Above 10 hp	20	23
Diesel engine	Up to 10 hp	6099	6189
	Above 10 hp	101	120
Electric pump	Up to 10 hp	597	663
	Above 10 hp	27	39

Source: Agriculture Department, Gandhinagar.

Fig.1 Location of Godhra taluka in Panchmahal district

Fig.2 Land holdings in different years

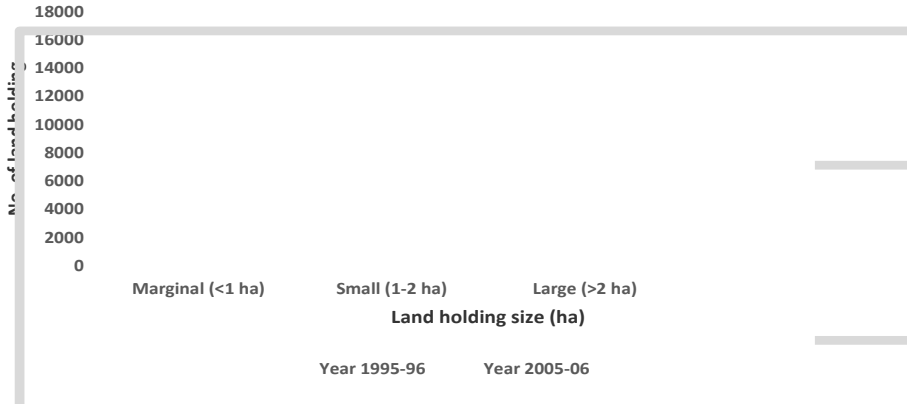


Fig.3 Availability of manual operated implements

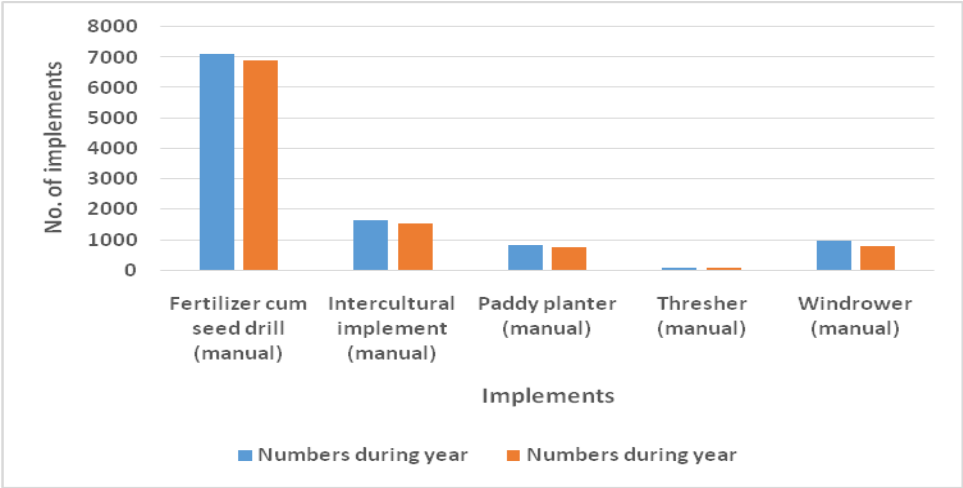


Fig.4 Availability of animal operated implements

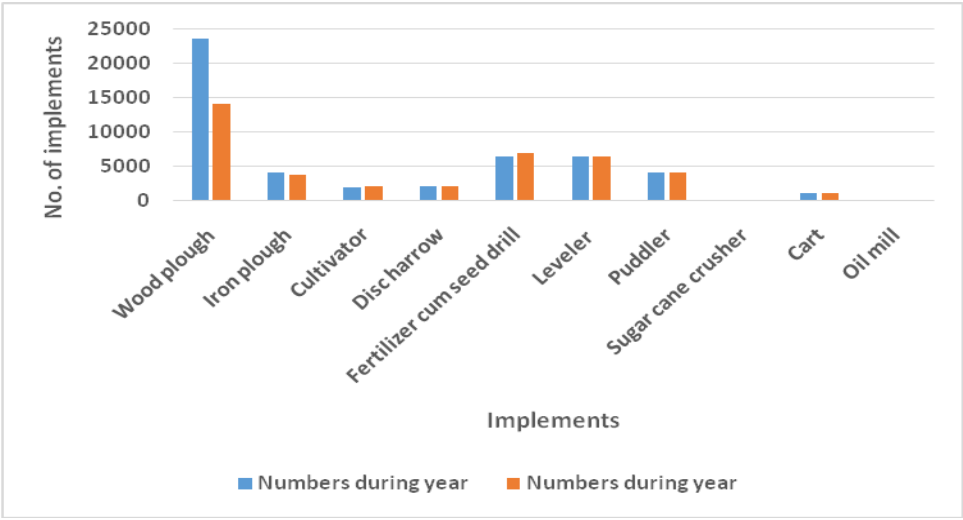


Fig.5 Availability of tractor drawn implements

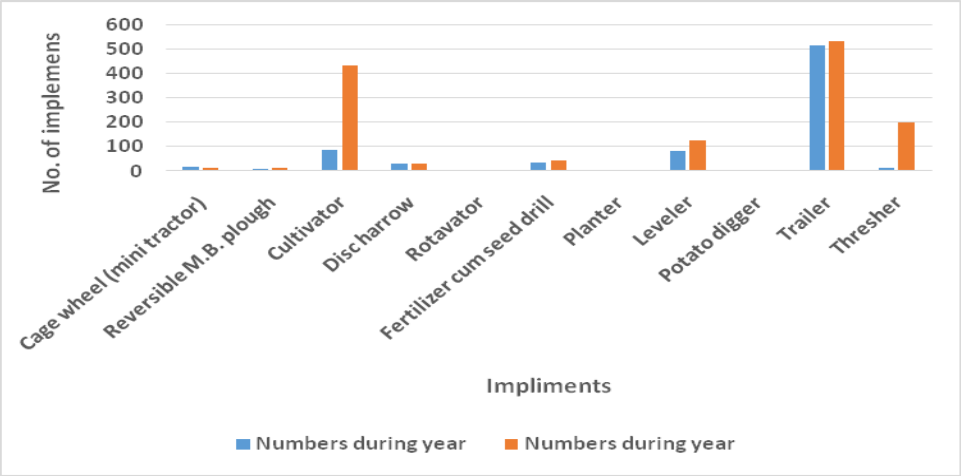


Fig.6 Availability of draught animals in Godhra taluka

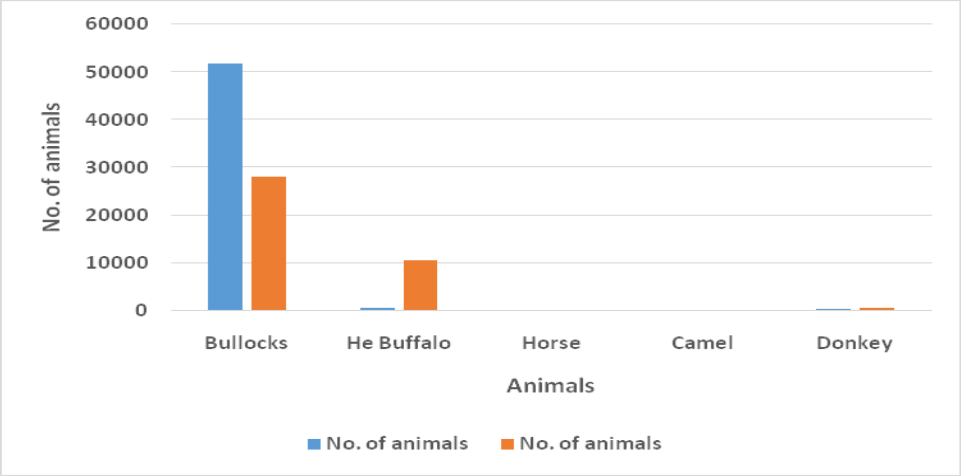
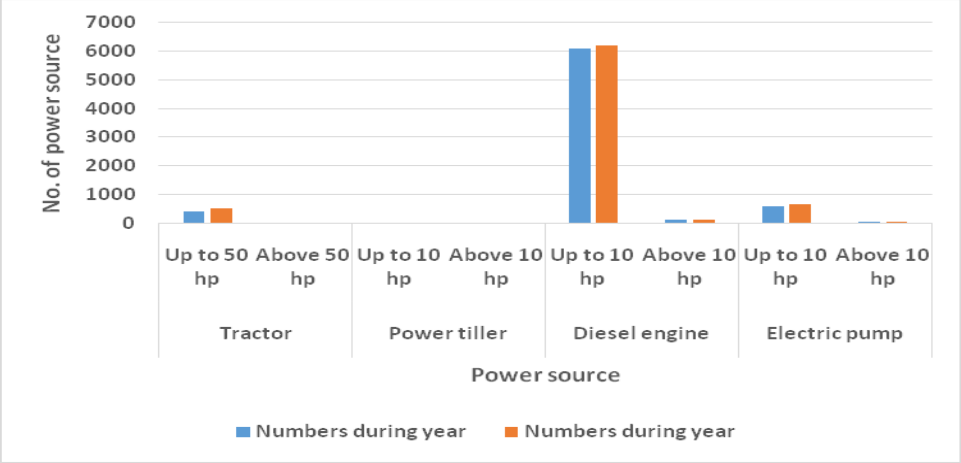


Fig.7 Year wise availability of mechanical power sources in Godhra taluka



Electrical power

The electric power was used mainly as electric pumps. Their total number increased from 624 to 702 in 2007 (above table). Increase was both in case of upto 10 hp and above 10 hp electric pumps (above table). This indicates that more and more area is coming under assured irrigation, which in terms will increase the intensiveness of agriculture and farm production. This will require timely completion of agricultural operations. To accomplish this more use of farm implements and farm power is required.

It is clear from the above discussion that the trend of farm power utilization is towards the use of mechanical power. Use of animal power is decreasing day by day. To increase the agricultural production, use of mobile farm power sources are to be increased i.e. tractor or power tiller population. The average land holding size is decreasing and number of small and marginal farmers is increasing continuously. This indicates that lower hp tractors or power tillers requirement will be there for smaller farms. As average power requirement per ha is only 0.5 hp. Thus, more than 73 % land holdings in Godhra taluka requires power tillers or mini tractors. This number may increase in future. Less than 27% land holdings may employ bigger hp tractors.

In conclusion, availability of adequate farm power is very crucial for timely farm operations for increasing production and productivity and handling the crop produce to reduce losses. With the increase in intensity of cropping, the turnaround time is drastically reduced and it is not possible to harvest and thresh the standing crop, on one hand, and prepare seed bed and do timely sowing operations of subsequent crop, on the other hand, in the limited time available, unless adequate farm power is available. The average farm power availability in India is 1.65 kW/ha in 2001and it is envisaged that by 2020 the average farm power needed will be about 2 kW/ha to feed the growing population.

Godhra taluka of backward district Panchmahal is agriculture dominated tribal area, where economic condition of farmers is very pity due to low level of agricultural productivity. To uplift the economic status of the farmers by means of enhanced productivity, it is essential to estimate the farm power requirement so that future strategies may be formulated. Keeping this in view, the study was conducted by collecting data from secondary sources regarding land holding pattern, animal census, farm power implements used and area under different crops. Data was investigated and following conclusions were drawn:

Bullocks population was less than 100 in 21.1 % villages while more than 69.73% villages had bullocks population less than 500 in the year 2007.
Lower hp tractors are preferable in the region as more than 90% tractors were less than 50 hp.
Higher hp power tiller are popular as more than 70 % power tillers were having hp greater than 10.
Diesel engines and electric pumps of less than 10 hp were more in use.
The average land holding size of the taluka is decreasing day by day. It decreased from 2.12 ha to 1.36 ha during 1995-96 to 2005-06. Thus, lower hp per land holding will be required in future.
The area under grain crops are increasing. Thus, to perform more intensive operations more power will be needed.
Tractor drawn implements are increasing day by day while manual operated implements are decreasing. Thus, shift is towards of mechanical power.

Available animal power was decreasing while mechanical power was increasing.

In future demand of mini tractors or power tillers will be more as compared to other farm power sources.

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