

SOURCES OF FARM POWER

A farm power for various agricultural operations can be broadly classified as:

(1) **Tractive work** such as seed bed preparation, cultivation, harvesting and transportation, and

(2) **Stationary work** like silage cutting, feed grinding, threshing, winnowing and lifting of irrigation water.

These operations are done by different sources of power, namely human, animal, oil engine, tractor, power tiller, electricity and renewable energy (biogas, solar and wind).

HUMAN POWER

Human beings are the main source of power for operating small tools and implements. They are also employed for doing stationary work like threshing, winnowing, chaff cutting and lifting irrigation Water. It is generally believed that there is surplus human power available for agricultural operations in India. According to 2001 census figures, the total Indian rural population is about 74 crores. Of the total rural population only 30 per cent is available for doing farm work. Hence the total number of persons available would be about $74 \times 0.30 = 22.2$ crores. This figure includes both the landless labourers as well as the owners of farms in the country. On the average a man develops nearly 0.1 horsepower (hp.). Therefore, the total power available through human source may be about 2.2 crore hp. But there is a steady decline in the number of landless labourers available for doing farm work in rural areas.

Population and Agricultural Workers						(In Millions)	
Year	Total Population	Average Annual Exponential Growth Rate(%)	Rural Population	Cultivators	Agricultural Labourers	Other Workers	Total
1991	846.3	2.14	628.7	110.7	74.6	128.8	314.1
			(74.3)	(35.2)	(23.8)	(41.0)	(100.0)
2001	1027.0	1.93	741.7	127.6	107.5	167.4	402.5
			(72.22)	(31.7)	(26.7)	(41.6)	(100.0)

Managing Labour Peaks: In crop production system, labour peaks develop due to high labour demands in operations, which cannot be or have not been mechanized so far. For example,

the operations like transplanting of paddy, weeding and inter-culture operations or harvesting of crops demand large number of human labour on each of the farms in the region. Such peaks have got to be managed if one desires to have high return from his enterprise. In general, the peaks are managed as follows:

- i) Increasing the working hours.
- ii) Extending the time period of operations.
- iii) Adjusting the cropping pattern.
- iv) Mechanizing the operations, wherever possible.
- v) Decreasing the intensity of some operations.

Advantages: Easily available and used for all types of work.

Disadvantages: Costliest power compared to all other forms of power, very low efficiency, requires full maintenance when not in use and affected by weather condition and seasons

ANIMAL POWER

The most important source of power on the farm all over the world and particularly in India is animal. It is estimated that nearly 80 per cent of the total draft power used in agriculture throughout the world is still provided by animals, although the number of agricultural tractors has become double after every ten years since 1930. India with its 22.68 crore cattle possesses the largest number of cattle in the world. Among them the bullocks and buffaloes happen to be the principal sources of animal power on Indian farms. However, camels, horses, donkeys, mules and elephants are also used for the farm work. The average force a bullock can exert is nearly equal to one tenth of its body weight. But for a very short period, it can exert many more times the average force. Generally a medium size bullock can develop between 0.50 to 0.75 hp. Thus the variation in power developed by animals is considerable. Actually small size bullocks are not able to develop even 0.50 hp and most of them are not fit for heavy work. Animals can be a very cheap source of farm power if raised by the farmer himself. It becomes the most costly source if the animal has to be bought from outside. Considering the overall situation of the draft animals available in the country, it is estimated that the total work animals may be about 7.56 crores in number, that is 33 per cent of the total horse power output from the animals would be about $7.56 \times 0.50 = 3.78$ crore hp.

Advantages: Easily available, Used for all types of work, Low initial investment, Supplies manure to the field and fuels to farmers and Live on farm produce.

Disadvantages: Not very efficient, Seasons and weather affect the efficiency, Cannot work at a stretch, Require full maintenance when there is no farm work, Creates unhealthy and dirty atmosphere near the residence and Very slow in doing work.

MECHANICAL POWER

The third important source of farm power is mechanical power that is available through tractors and oil engines. The oil engine is a highly efficient device for converting fuel into useful work. The efficiency of diesel engine varies between 32 and 38 per cent, whereas that of the carburettor engine is in the range of 25 and 32_per cent. In recent years, diesel engines and tractors have gained considerable popularity in agricultural operations. Small pumping sets within 3 to 10 hp range are very much in demand. Likewise, oil engines of low to medium speed developing about 14 to 20 hp are successfully used for flourmills, oil ghanis, cotton gins, etc. Diesel engines of the larger size are used on tractors. It is estimated that about one million tractors of about 25 bhp range are in use for agricultural operations in India. Similarly, the total number of oil engines for stationary work may be taken as about 60 lakhs of 5 hp each. Thus the total power available from mechanical source would work out to be 55 million hp (Oil engines = $0.60 \times 5 = 3.0$ crore hp, tractors = $0.1 \times 25 = 2.50$ crore hp).

Advantages: Efficiency is high; not affected by weather; can run at a stretch; requires less space and cheaper form of power

Disadvantages: Initial capital investment is high; fuel is costly and repairs and maintenance needs technical knowledge.

ELECTRICAL POWER

Now-a-days electricity has become a very important source of power on farms in various states of the country. It is steadily becoming more and more available with the increase of various river valley projects and thermal stations. On an average about 1/10th of the total electrical power generated in India, is consumed for the farm work. The largest use of electric power in the rural areas is for irrigation and domestic water supply. Besides this, the use of electric power in dairy industry, cold storage, fruit processing and cattle feed grinding has tremendously increased.

Advantages: Very cheap form of power; high efficiency; can work at a stretch; maintenance and operating cost is very low and not affected by weather conditions.

Disadvantages: Initial capital investment is high; require good amount of technical knowledge and it causes great danger, if handled without care.

WIND POWER

The availability of wind power for farm work is quite limited. Where the wind velocity is more than 32 kmph, wind mills can be used for lifting water. Even today in India the wind power has not been fully harnessed. The most important reason is its uncertainty.

Experimental results show that a wind mill having 3.6 diameter wheel mounted on 12.0 m tower is able to produce from 0.1 to 0.9 hp with the wind velocity varying from 6.4 to 37 km/h. Thus the average capacity of a wind mill would be about 0.50 hp. There are about 2540 mills installed in India. Hence the total output may be about 1250 hp only, but it is one of the cheapest sources of farm power available in the country.

Ministry of Non-Conventional Energy, Govt. of India have been making efforts to popularise the wind mill for power generation and water lifting in rural areas. But this source could not become attractive due to the following limitations of the system :

- Initial investment is high,
- Repair facilities are not available in rural areas,
- Even the matching pump sets and electric generators are not readily available in the country,
- It not suitable for all situations in the country. For the present, the wind mills have limited scope of the use in the country.

Comparison of Tractor and Animal Power:

S. No.	Basis	Tractor /Power Tiller	Animal Power
1.	Availability	Only large size tractors above 25 hp size are available. Tillers up to 12 hp size are available	They are available in plenty.
2.	Overload capacity	Limited overload capacity	Very high overload capacity for short time.
3.	Acceptability	Not very common because of high initial investment	The most important source of power at present.
4.	Tractive work	This the best source of power for any traction job. With cage wheels it can be use for puddling also.	They are quite suitable for all kind of farm work.
5.	Stationary work	All kinds of stationary works can be performed.	Bullocks have limited use for such works.
6.	Transport work	It is a quick means of medium distance transport.	Bullocks are also used for short and medium distance transport work.
7.	Initial investment	Though cost per horsepower is low but overall investment per unit area is very high.	Cost per horsepower is high but overall investment is less.
8.	Cost of maintenance	Reasonable	Very high.
9.	Rate of depreciation	It is about 10 per cent year.	In fact the value increases in the beginning and then decreases.
10.	Cost of operation	Cheaper per horsepower hour.	It is costlier than tractor.
11.	Limitations	The technical know how of the people in general is low and as such farmers get discouraged to buy a tractor. This may no longer be valid in next 20 years. Tractor gives low field efficiency in small fields.	Constant care is required to keep the animal in good health. To some extent medical facilities are now available and as such it is not very difficult to cure a sick animal in rural areas.
12.	Idleness	It does not consume any fuel or lubricant while not in use.	Even during Idle period, it needs care, feed and fodder. But, on the other hand, it provides manure for the crops.
13.	Output	Very high and suitable for timely operations.	Low output.