

Status of Mechanization of Small Farms in India

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ABSTRACT

In Indian agriculture, the energy use pattern has played dominant role in influencing the level of mechanization. Besides that the agro-climatic factors as well as the size of holdings do affect the degree of mechanization. Nearly 30 percent of total cultivated area is owned by 76 percent of the small and tiny land holders each owning even less than a hectare. On the other hand, about 2 percent of land owners cultivate about 20 percent of the total cultivated land. These variabilities have greatly influenced the ownership of power sources on Indian farms. Small farmers, employ human and animal energies with the use of hand tools and animal drawn equipments. Whereas, the use of tractors, power tillers, electric motors, etc. on small farms is on a marginal scale. There are few pockets and also extensive wheat growing regions where mechanical and electrical power sources are extensively used in production agriculture leading to about 185% of cropping intensity. In that region, the animal energy is employed for on the farm transport of fertilizers, fodders and fuel to support milch animals and other household activities. In spite of high degree of mechanization, the harvesting of crops is done by human labour with few exceptions of harvesting wheat crops by combines in few pockets.

In overall assessment of mechanization, the following conclusions are drawn:

- i) Farm operations which show a growing trend of mechanization are (a) tillage, (b) seeding (c) Irrigation (d) Plant protection application (e) Threshing and (f) Transport.
- ii) Crop cultivation system in respect of wheat, maize and sorghum have been greatly mechanized.
- iii) The least mechanized cropping systems are (a) vegetable production and (b) cultivation of sugarcane, cotton, rice and pulses.
- iv) Annual production of tractor has touched the figure of 280,000 by 1995 and the total number has crossed 1.5 million on Indian farms

INTRODUCTION

Indian agriculture is predominantly practiced on small farms ranging from about 0.5 ha to 10 ha as presented in table 1. these tiny and small farms are situated in about 15 macro or 127 micro agroclimatic zones covering a total area of about 140 million ha of which about 30 percent is in irrigated zones and 70 percent in rain-fed zones. Productivity of agriculture is highly variable due to many factors predominantly being status of energy use, seed quality, the timeliness of farming operations, management of inputs, etc. The level of mechanization of the Indian farms is also highly variable. Energy use pattern is so inconsistent that the

variability in use of energy in two extreme conditions may vary about 5 folds for the same crop of rice in different zones.

however, the productivity differences may not be more than three folds or so in low and high productivity zone.

In general, the level of mechanization of farms may be categorized as follows :

- i . farms totally dependent on manual power source using traditional hand tools only
- ii. Farms where human and animal power sources are employed with mixed type of hand tools and farm implements
- iii. Farming system where human power, animal power, mechanical power and electrical power sources are employed in combination with matching implements / attachments
- iv. Farms using tractors, electric motors and human labour are considered highly mechanized farms but are in small number

Level of mechanization in irrigated agriculture producing wheat, rice and maize is higher than rice producing zones of the country. Level of crop intensity is about 133 percent for India and it varies from 100 to 300 percent.

Farm operations which have received greater degree of mechanization are as follows :

- i . Lift irrigation operations
- ii. Plant protection operations
- iii. Tillage and seeding operations
- iv. Threshing of cereal crops
- v. Farm transport is getting progressively mechanized.

Almost each and every bullock farmer owns plough, a seeder and a leveler. Whereas a tractor farmer owns a plough or a cultivation, a seeder or trailer and a disc harrow as an operational equipment.

In so far as the post harvest operations are concerned, the status of mechanization is as follows :

- i . Rice milling is highly mechanized.
- ii. Edible oil extraction is mechanized.
- iii. Flour grinding is mechanized.
- iv. Pulse milling is mechanized using traditional machines.
- v. Milk processing and packaging is considerably mechanized.

MECHANIZATION TRENDS

Some of the most well understood indicators of the level of mechanization are the number of tractors and other machines used per 1000 ha, the KW/ha power available for use and the growth pattern of power machines being introduced annually on the farms. Itemwise details

are presented as follows :

1. Tillage Operations :

Even though the total number of tractors in use on Indian farms has crossed the figure of 1.5 millions (Table 2), their number remains only eleven tractors per 1000 ha. The annual production of tractors in India is of the order of 0.18 million since 1994 and the figure is rising each year. In some of the rice-wheat regions of India, the number of tractor availability is of the order of 60 per 1000 ha. Contrary to that, the North-East hilly region of the country has extremely low populations tractors i.e. less than even one tractor per 1000 ha. Under such extreme variability of tractor populations in different regions, the farmers have to depend on animal power and human muscle power to perform the agricultural operations. In highly mechanized zones, animals are used for short distance transport only.

With the present tractor and small power tiller population, hardly 20 percent cropped area is tilled and sown under different crops with mechanical power sources. The rest of cropped area managed with animate power sources. Similarly, most of the hill regions and 100 percent of the shifting (JHOOM) cultivation is managed with human muscle power only. Incidentally, about 12 million ha (9%) of cultivated area remains poorly tilled or fallow due to non availability of adequate power sources. Hence, there is an excellent scope of introducing mechanical power i.e. tractors and power tillers to achieve respectable productivity as well as for cultivation of total cultivable area in the country. It is because of low level of mechanization and availability of power, the annual large scale tractor population is getting absorbed in Indian farming. This trend is likely to be continued till the tractor population gets at about 3.0 million mark.

Somehow, the growth of power tillers is of the order of about 10,000 units per year and most of these machines are being used in the rice cultivation in the Eastern and Southern India.

To achieve high degree of power utilization, the matching (power) implements for the tractors and energy efficient improved animal drawn implements have to be introduced in Indian farming system. A vigorous drive is to be made by the Department of Agriculture, the

manufacturers and the research scientists to achieve the above goal of success.

It is worth nothing that most of the small farmers having no bullock power usually hire tractors for tillage operations.

2. Seeding and Ttransplanting

Indian farmers have realized the benefits accrued to them by way of using improved seeders and planters in their farming system.

Uses of improved seeders and manually operated rice transplanters are being encouraged in the country. However, good success has been achieved in introducing improved seed drills for sowing wheat, rice, maize, millets and some oil seed crops. But there is a long way to go to convince farmers to accept rice transplanters, sugarcane planters, potato planters, etc. The use of even seeders for small seeds of Pearl millets, Rape seeds, Mustard and bold seeds like ground nut crops is highly insignificant and needs to be encouraged to replace in efficient system.

3. Interculture and Plant Protection

Knowing the importance of weed removal from cropped area and also controlling pests & diseases, the farmers do use weeders and plant protection chemicals. Most of the weeding is done by hand tools and animal drawn equipments. In so far as the application of plant protection chemicals are concerned, it is done with improved manually operated machines and power operated sprayer. Use of tractor operated machines and aerial spraying is done limited extend

All types of weeder and plant protection machines are produced and marketed by Indian manufacturers in the country. Maximum intensity use of these machines is noted for spraying chemicals in cotton crops, rice fields and grape vines.

Mechanical weeding of orchards and plantation crops is on a limited scale by small tractors and power tillers.

4. Irrigation Equipments

Irrigated cropped area is increasing annually. Most of the irrigated areas are under river commands and only small percentage is covered by lift irrigation i.e. pumps, tubewells and muscle power operated devices. Presently(1996) over 14 million pumps including tube wells have been energised to lift underground as well as surface water for irrigation use. Most of these are low lift pumps which are either driven by diesel engines or electric motors

Even in the presents stage of modernisation, the following mix of water lifting devices have been noticed:

- i Most modern sprinklers and drip irrigation system are being popularized and use for commercial crops and plantations crops.
- ii Hundred thousands of low lift water lifting devices as well as medium depth animal drawn, water lifts are being operated by small farmers and vegetable growers.
- iii Hydrams and solar devices for pumping water are being introduced in hilly region

and also in those areas where sun shines for more than 200 days a year

5. Harvesting and Threshing

Most of the harvesting of oil seeds, pulses and plantation crops is carried out manually. However, the cereal crops i.e. wheat and rice are harvested by combines as well as manually. Only about 10 percent of the wheat crops and 2 percent of paddy crops are harvested mechanically. Hence, there is an excellent scope of popularising appropriate mechanical harvesters on Indian farms. Of course, the indigenous production of combines and reapers have been to a greater advantage of farmers in promoting mechanization. Some of the studies carried out in India indicate the following trends.

- i. Cotton pickers and sugarcane harvester are in good demand.
- ii. Paddy harvesting and the harvesting of oil seeds and pulses need to be mechanized to achieve timeliness operations so as to reduce losses.

- iii. Custom hiring system of harvesting will be most acceptable to the farmers in India.
It is being practiced for harvesting wheat, rice and soybean crops.
- iv. Crop binders could not be accepted by Indian farmers.
- v. Indian farmers will like to use a wheat combine which does reaping, threshing and 'Bhusa'(Chaff) making. Wheat straw is a valuable by product and fed to animals.

Threshing of harvested crops was considered to be most drudgeryful operation till large scale threshers were introduced in India farming. It is estimated about 15 million threshers are in use in India. These machines are used as custom hired ones for threshing wheat, gram, linseed, lentil, peas, soybean, maize, pearl millet, sunflower, rapeseed, mustard, etc. Mechanization of Rice threshing is at low key. Similarly, threshing of few pulses and other oil seeds need to be mechanized to remove human drudgery in India. By any standard, mechanization of threshing in India has gone ahead extensively during last 20 years. Annual production of various types of threshers is estimated as 110,000 machines. Presently, there is a greater demand of high capacity (more than 1.5 tonne per hour) machines.

PROBLEMS OF SLOW MECHANIZATION

Some of the basic problem which have created hindrances in growth of mechanization are;

- i. Non-existence of long term mechanization policy in the country.
- ii. Low prices of farm outputs compared to International prices.
- iii. High prices of farm machines and tractors.
- iv. Low capacity of farmers in taking risks of mechanization.
- v. Fragmentation of land holdings.
- vi. Inadequate infrastructure for production, marketing and popularization of farm implements and machines.
- vii. Passive attitude of financial institutions towards mechanization of Indian agriculture.
- viii. Non-existence of service after sales facilities, training programmes and counseling of farmers to promote mechanization.
- ix. Poor quality matching implements and even their non availability in remote areas.
- x. Poor infrastructure to promote and support mechanization of agriculture.
- xi. Availability of large labour force on farms.

RESULTS

Indian Agriculture has long history of employing human and animal power sources for pulling and/or pushing traditional implements and hand tools to raise crops. In its second phase, the improved implements and efficient hand tools were introduced in the first half of the 20th century. However, the mechanical power as a source of energy on Indian farms was introduced in late 50s by importing farm engines, farm tractors and matching implements. The production of farm tractors commenced in late 50s and that of the powertillers in late 60s. By the mid 60s, more than two tractor manufacturers established their plants in India. Today(1996) more that 20 tractor manufacturers, and equal member of combine fabricators

have been fabricating and marketing these machines in India. Similarly, a large number of manufacturers are engaged in fabrication of pumps, engines, motors, plant protection machines, threshers etc.

In so far as small scale units fabricating hand tools, bullock drawn implements, etc. are concerned, they are of the order of over 3000 units. In order to have some controls in the quality, Indian standards were developed and introduced in early 60s. Over 200 standards have been formulated in India. In spite of substantial growth which has taken place in mechanization of agriculture, about 85 percent area is tilled by animal and human power source. Of course, growth of mechanization in operations such as irrigation, plant protection application, seeding and threshing is appreciable. What is lacking today is that high quality energy efficient hand tools and matching implements be produced and popularised. Training courses, financial supports coupled with well organized extension system be organized to promote mechanization. Production of quality machines and their availability all over the country are far from satisfactory. Another very important factor which attracts the attention of policy makers is that the long term mechanization policy be formulated so that supporting system could be developed to achieve the desired goal. In its normal way, the planting, the irrigation, the plant protection operations, the threshing and farm transport operations have been considerably mechanized. Yet there is enough scope to modernize it and take it further ahead.

Another very important factor which can not to be ignored to promote appropriate mechanization is the liberalization of International trade leading to the establishment of joint ventures and import of technologies for agriculture.

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Table 1. Distribution of operational land holdings in India

category of holdings	No. of holdings, million (percentage)	Area operated, million ha (percentage)	Average size of holdings (ha)
Marginal < 1 ha	56.8 (58)	21.6 (13.2)	0.38
Small 1 - 2 ha	17.9 (18.3)	25.5 (15.6)	1.43
Semi - medium 2 - 4 ha	13.3 (13.5)	36.6 (22.3)	2.76
Medium 4 - 10 ha	7.9 (8.1)	47.0 (28.7)	5.94
Large more than 10 ha	1.8	33.2 (20.2)	17.20
All holdings	97.7 (100)	163.9 (100)	1.68

Table 2. Annual production of tractors in Indian showing growth pattern

Year	Numbers	Year	Numbers (1000)
1960	880	1980	69.50
1965	4,323	1985	115.60
1970	17,099	1990	140.20
1975	33,252	1995	180.50