

## 2. PRESENT SITUATION AND FUTURE PROBLEMS ON FARM MECHANIZATION IN INDIA

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### Introduction

Out of the total geographic area of 326.8 million hectares, about 136 million hectares is under cultivation. Agriculture and allied activities account for nearly half of the country's national income, with about 70% of the population dependent on land for their living. From the total cropped area, about 23% of the land is under rice, 15% under pulses, 8.5% under wheat, 8.5% under oil seeds and the remaining area under crops like jowar, cotton, potatoes, jute, fruits, vegetables, etc.

Out of 50.7 million holdings, operating an area of 134 million ha, the holdings less than 5 ha is 86.5% covering an area of 48.3%. Holdings over 5 ha cover 51.7%. Though the average size of holding is 2.63 ha, the large number of farms in the small, medium and large sizes offer scope for intensive use of different power combinations as per details given below:-

Farm size	Power source best suited	No. of holding (in 1000)	Percentage of total holdings	Land area (in 1000)	Percentage of total land area
0-2.02 ha (0-5 Ac)	Manual labor and hired bullock or tractor power	31,320	61.7	65,000	19.3
2.42-5.45 (5.1-12.05 Ac)	Bullock pair-hand tractors	12,614	24.9	96,000	28.9
5-45-10.1 ha (12.6-25 Ac)	Multiple bullock pair/or low h.p. tractors/or hired tractor power	4,538	8.9	76,500	22.9
Above 10.5 ha (25.1 Ac)	Tractor power	2,294	4.51	96,500	28.9

### Mechanization activities during the 1st decade of planned development and thereafter

During the First and Second Five Year Plans, emphasis was given to development, introduction and popularization of improved, manually operated and bullock drawn implements. During the Third Plan period, facilities for research, development and testing of animal and power operated equipment were established. Special programmes for demonstrations and popularization were also taken up. As a result of these, there was a rapid growth in the use of different types of agricultural implements and contributed towards modernization of farming techniques.

The need for a large-scale mechanization programme was recognised during the Third Plan period. Production of tractors and different types of power driven equipment was organized. For meeting the requirements of personnel trained in the operation, maintenance and repair of tractors and other sophisticated farm machinery,

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training centres were set up at national and State levels. A National Farm Machinery Testing Station was established at Budni in the State of Madhya Pradesh for testing of tractors, pump sets and other power operated equipment. Graduate and post-graduate courses on farm machinery, soil and water conservation, irrigation and drainage, processing, etc., were organized in the different agricultural universities.

### The need for mechanization

During the past few years, there has been an un-precedented rise in the demand for all types of farm equipment. Farmers, more than ever before, are eager to buy well designed tools and equipment for maximizing production from land. With the rise in wages for manual labour and cost of maintenance of bullocks, together with non-availability of labour during peak seasons, especially in intensively farmed and newly developed areas, use of tractors and other equipment has become necessary and more economical. In most of the intensively farmed areas, even farmers with 20 acres of land found it necessary and economical to possess tractors in the 20~35 hp range. With the introduction of high yielding varieties and multiple cropping, lack of power on Indian farms for performing the different agricultural operations has become a major bottleneck in further increasing the area under multiple cropping. It is estimated that for a reasonably efficient agriculture, about 1.0 hp per hectare is required. Thus, about 136 million hp is required as against about 30 million hp currently available from work animals, tractors, diesel engines, etc. in use for agricultural purposes. This gap will have to be filled by tractors and power tillers, etc. as further increase in animal population will create competition for food with human beings.

While mechanization represents an investment, and is not possible until the bonds of subsistence farming have been broken by new technology in seeds, fertilizers, plant protection and marketings, it may be said that we have reached this stage in a number of regions in India. Apart from the role of equipment input to improve the utilization of other inputs, seeds, irrigation, water, etc., the country is already faced with a problem of migration of the rural youth to the city. The combination of long hours of work and unattractive working conditions that exist with traditional methods of farming accelerates the process. All types of equipment that reduce drudgery on the farm to some extent arrest the rural 'brain-drain' and have long term benefits to the city as well as to the farm.

### Growth of farm equipment population

During the last decade, there has been a rise in the population of all types of farm equipment. The following table illustrates the growth in the population in selected items of farm equipment:-

	1951	1956	1961	1966	1970 (In 1000 nos) (Estimated)
Tractors	8.6	20.9	31.0	55.2	120.0
Power tillers	—	—	—	4.7	6.0
Electric pump sets	26.2	46.9	160.1	366.0	1200.0
Oil engines used for irrigation	82.45	123.0	230.0	441.0	850.0
Manually operated sprayers & dusters	—	—	—	—	293.0 (as on 1968)
Power dusters and sprayers	—	—	—	—	33.7 (as on 1968)
Self propelled combine harvesters	—	—	—	—	450

### Demand trends and supply for tractors and power tillers

The working group on Agricultural Machinery and Implements has estimated the annual demand of wheeled tractors and power tillers during 1973~74, at 90,000 and 80,000 nos. respectively.

There are currently 5 firms engaged in the production of tractors with a sanctioned capacity of 30,000 tractors per annum. Production of tractors in India, during the past few years has been as under:-

1961-62 .....	880
1962-63 .....	1,414
1963-64 .....	1,983
1964-65 .....	4,323
1965-66 .....	5,714
1966-67 .....	8,816
1967-68 .....	11,394
1968-69 .....	15,466
1869-70 .....	17,099

The manufacturers have achieved an indigenous content of about 85% and imports are limited to special items like hydraulics. With steps being taken to set up new manufacturing units for increasing the capacity of manufactures and few organization having developed their own designs of tractors, it is expected that production would rise to about 70,000 nos. in the next 3~4 years.

There are two firms currently engaged in the production of power tillers. Since production is far below the requirements, the gap between indigenous availability and demand is partially met out of imports of Yanmar, Kubota, Mitsubishi, Iseki and Satoh power tillers from Japan and also from other countries. Bulk import of power tillers is confined to makers which have an approved programme of manufacture in India.

### Improved implements and power operated equipment

A wide range of improved bullock drawn implements for tractors and also equipment for plant protection, electrical and diesel engine operated pump sets, equipment for seed processing etc., are manufactured by a large number of firms in the small scale and organized sectors. Critical components such as discs, required for the manufacture of tillage implements are also under production by several manufacturers. With a reasonably well-developed industrial base, there is no difficulty for manufacture of most of the agricultural implements. There is, however, considerable scope for organizing production of certain types of specialized equipment, the demand for which is yet to develop.

The working group on Agricultural Machinery and Implements for Formulation of IV Five Year Plan proposals has assessed the demand for agricultural machinery and implements. The estimated demand for some of the specialized equipment, towards 1973~74, is as under. The production of these items are either insufficient or is yet to be organized:-

**Harvesting equipment:** The Research Stations in India are engaged in the development of high yielding and short-duration varieties of crops. During the past few years several new varieties have been developed and introduced in the country. The introduction of these permits intensive farming with multiple cropping. In the case of wheat and paddy, harvesting in certain areas is considerably delayed resulting in heavy damage to crop. In these areas, use of mechanical equipment has become neces-

Items	Demand toward 73-74	Remarks
1. Reversible mouldboard & disc ploughs—2 and 3 furrow	4,000	
2. Scrapers, capacity 2 to 3 cubic yard-hydraulically operated suitable for 30 to 50 hp wheeled tractors	4,500	
3. Front mounted dozer blades for 20 to 50 hp tractors	3,200	
4. Intercultivators—mounted type	6,000	
5. Intercultivators—disc type	3,500	
6. Fertilizer attachment for interculturators	5,700	
7. Tractor rear mounted sprayers and dusters	5,000	
8. Tractor mounted gas/liquid, fertilizer applicators	4,000	
9. Rotavators 4' to 6' wide	4,000	
10. Tractor windrower	1,000	
11. Paddy combines/binders	2,500	
12. Field forage harvester	1,000	
13. Rotary choppers/slathers	900	
14. Groundnut diggers	2,500	
15. Potato planters	2,500	
16. Potato diggers & harvesters	2,500	
17. Crop driers—low capacity—portable	2,600	
18. Power thresher for paddy automatic type	3,500	
19. Tractor mounted, hydraulically operated loaders & lifters	400	

sary. There is a large demand for self-propelled combine harvesters in the wheat growing regions and there is a felt need for modernizing harvesting of rice especially in areas where double cropping is practiced.

**Standardization:** For ensuring quality and inter-changeability, some of the important implements and tools have been taken up for standardization by the Indian Standards Institution. Besides standards for components and assemblies, test codes on agricultural machinery and implements are also being standardized for enabling the Regional Testing Stations in taking up comparative testing of similar equipment so that the results of tests would serve as an aid to the purchasing agencies, for the selection of makes and models which are of good performance, to the Extension Workers and Govt. Departments for selecting makes and models that may be taken up for popularization.

#### **Support facilities for accelerated growth of farm mechanization**

Visualizing the extreme urgency in increasing the agricultural production through efficient supply of inputs, especially agricultural machinery and implements, during the Third Five Year Plan, Agro-Industries Corporations, which are Govt. companies were set up in almost all the states with the following principal objectives:—

- i) Distribution of agricultural machinery and implements as well as equipment needed for processing, dairy, poultry, fishery and other industries connected with agriculture;
- ii) enabling persons engaged in agricultural and allied pursuits to own the means

of modernizing their operation; through supply of equipment on early repayment terms;

- iii) undertaking and assisting in the efficient distribution of inputs for agriculture;
- iv) promotion and execution of industries having a bearing on production, preservation and supply of food; and
- v) providing technical guidance to farmers and persons concerned with Agro-Industries with a view to enabling efficient conduct of their enterprise.

These Corporations, in the initial stages, have been requested to concentrate upon programmes of;

- i) supply of costly agricultural machinery through hire purchase terms, the cost of equipment repayable over a period of 5~7 years.
- ii) organizing custom hiring and servicing of agricultural machinery and promotion of custom service ventures by supply of machinery and equipment on hire purchase basis;
- iii) distribution of agricultural equipment particularly non-traditional items with a view to popularizing their use.

The total paid up capital of these Corporations as on 1.6.'70 was of the order of Rs. 294.7 million. In some of the states, the Corporations have been able to pioneer hire purchase sales and distribution of inputs like fertilizers, pesticides, plant protection equipment, etc., contributing to the rapid development of agriculture in their states. The Corporations, besides organizing custom hiring and servicing centres especially in the areas where these facilities are not available, have also established manufacturing units for agricultural implements, processing units, etc.

**Credit supply:** During the Second and Third Plans, for popularizing improved implements, they were sold at subsidized prices, in some cases up to 50%. During the Fourth Plan, however, subsidies have been discontinued and popularization has been sought to be achieved through demonstrations and supply of credit. Land Mortgage Banks, Cooperative Institutions and Nationalized Banks have been encouraged to provide long term credit for tractors and other costly machines, and medium term credit, for tractors, power tillers and other agricultural machinery is expected to rise to about Rs. 1560.24 million towards 1973-74.

#### **Promotion of custom hiring and servicing, and operator training**

While the well-to-do farmers with large farms can afford to invest on costly machines, the small and medium farmers who form the majority have to be enabled in modernizing their farm operations by providing machine hire facilities at reasonable rates. Agro-Industries Corporations would, therefore, set up machinery hire units and workshops which assist private enterprises in establishing these facilities. Owner operators, cooperatives and individuals are assisted through priority allotment of imported agricultural machinery and through liberal supply of credit.

For meeting requirements of a large number of personnel trained in the operation maintenance and repair of agricultural machinery, Govt. of India have set up training centers in agricultural machinery utilization, at Budni (Madhya Pradesh) and Hissar (Haryana). At these national Institutes, courses of 1½ to 3 months duration are conducted. The Agro-Industries Corporations and Universities are also organizing training courses for users of farm equipment, supervisory staff of Govt. and quasi-governmental organizations. At the above two Central Institutions, besides training to users, training for trainers is also organized.

### **Special emphasis required for sound development of farm mechanization**

In many areas, planting is still carried out by the traditional method of broadcasting, instead of line sowing essential for efficient performance of intercultural operations like weeding, fertilizing, plant protection, etc., through use of improved implements and equipment. Farmers in their anxiety to tide over the peak seasons, initially concentrate on mechanizing tillage operations. Thus the tractors and power tillers possessed by them are under-utilized and they also utilize manual and bullock power for performing some of the operations. In a developing economy, it may be realized that mechanization efforts should be to tide over the critical periods so that the maximum production potential of land is exploited, with minimum displacement of the existing labour systems.

Small and fragmented holdings are a serious handicap for efficient utilization of implements. The age-old system of inheritance of land has led to division of larger fields into small and uneconomic units without development of adequate communication facilities between fields. This also makes proper layout of fields for more efficient soil conservation irrigation and drainage difficult. Special efforts would be needed for improving the layout of fields, through consolidation of holdings.

It has been the experience in India that the high temperature during the harvest seasons together with the shedding characteristics of new varieties of wheat increases the shedding losses. Timely harvest has thus become a very important factor. Timely harvest through mechanization no doubt would reduce harvest losses, but the need exists in the development of varieties better suited for mechanical harvesting.

### **Design, testing and development**

In most cases, a beginning in mechanization is made by developing countries by introducing equipment popular in the developed countries. Before large-scale introduction is taken up, very little effort is made to assess the suitability of imported machines for the special conditions that exist, and in adapting the machines to suit local conditions. When indigenous production is taken up, use of locally available materials presents problems of modifications and control of quality.

The standard of operation and maintenance in developing countries also tends to be poor and, therefore, satisfactory performance can be achieved only if the machines are designed to withstand a reasonable amount of abuse, both in operation and maintenance. While most of the agriculturally advanced countries have their own facilities for testing, research and development in agricultural machinery, the developing countries would find it difficult to invest large sums for the establishment of these facilities. I would, therefore, suggest that countries in the same region having identical farming and crop conditions should make joint efforts for research, development and testing. A similar approach should also be made for meeting special requirements of training and education.

One of the major problems faced by the developing nations in the rapid development of mechanization is the lack of high grade steel and other raw-materials needed for the production of agricultural equipment. Foreign exchange resources being meagre, to the extent possible, local production has to be organized, instead of importing complete machines. Incentives such as liberal import permits and exemption from local taxes and excise duty are necessary.

For organizing production of new implements, there could be considerable exchange of technical know-how among the developing countries and even of components and assemblies, depending on raw-material availability and development of local industry.

### **Special areas offering scope for mechanization**

In India, very little attention has hitherto been paid in the mechanization of transplanting of paddy, which is one of the major operations involved in the raising of this crop. Also, adequate attention has not so far been given to mechanization of crops like potatoes, groundnut, sugarcane and cotton. Special efforts by way of research, testing and evaluation are needed in adapting machines developed in other countries, where feasible comprehensive systems of mechanization have to be thought of, rather than modernizing a few of the operations involved in the raising of these crops.