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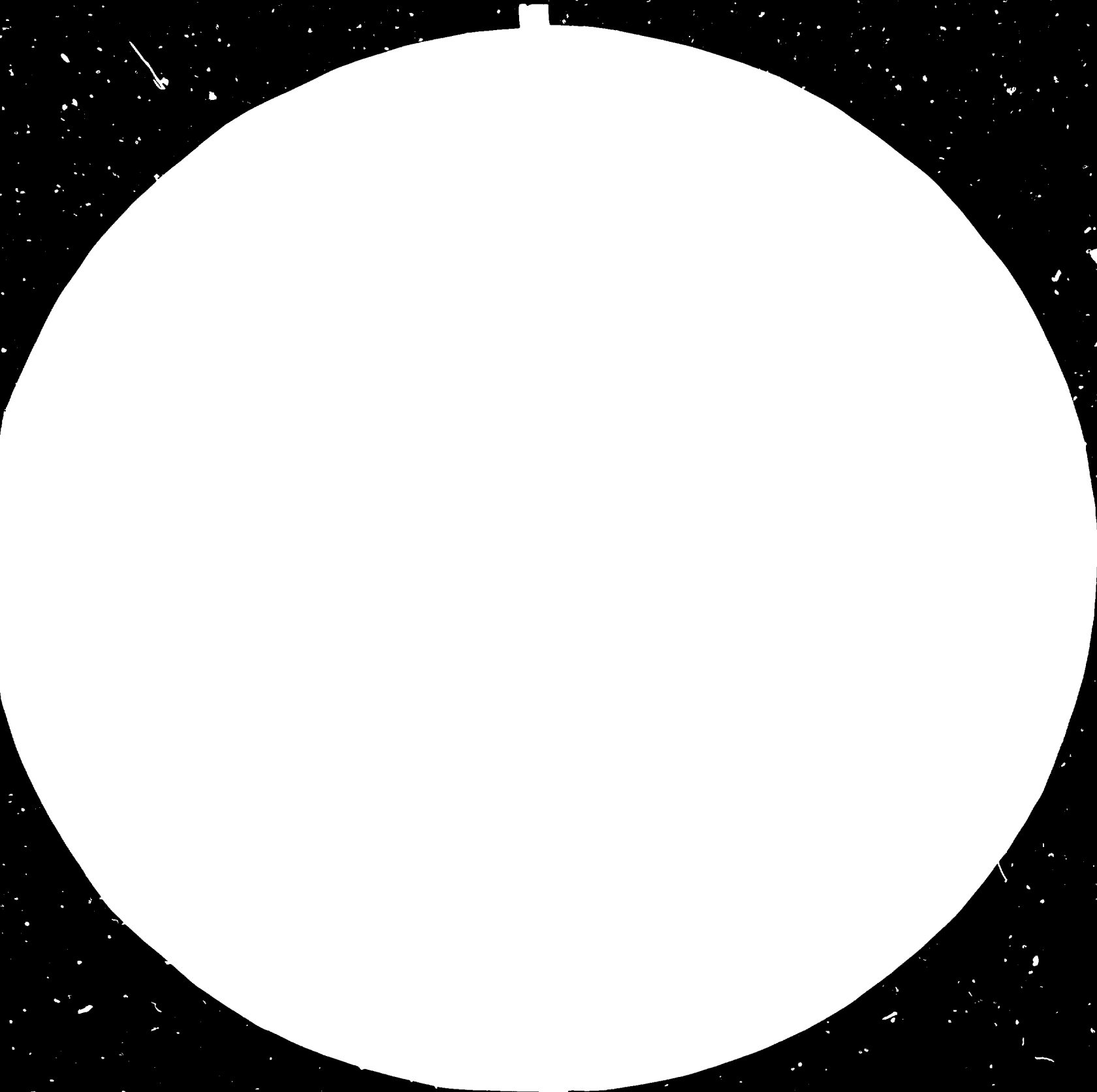
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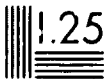
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STATUS PAPER

Mechanization of Indian Agriculture

by

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1. Introduction

India can be divided into 8 agro-climatic zones. These zones vary in their soil types and rainfall and temperature patterns. Nearly 30% of the total 140 million hectare of net agricultural area is irrigated and the remaining 70% is rainfed. These conditions have been responsible for selection of a particular farming system which fits in the local requirements. As a result of that the cultivation practices, the type of implements and the source of power used in these areas are unique to the area. However, during the last 15 years, the cropping pattern all over the country has undergone changes due to the creation of short duration dwarf high yielding varieties. This has also made considerable influence on the adoption of new types of implements to perform the operations timely and effectively.

Indian agriculture makes use of all types of machines, implements and tools which are powered by human beings, animal power tillers and tractors as the source of power. The other sources of power such as electric motors and internal combustion engines are extensively used for stationary work as prime movers.

The small holdings of Indian agriculture which are owned by 82 million farming households, averages out to be 2 ha. per family against 2.3 ha. per family about a decade ago. Today about 10% farming families own less than 2 ha, 86% own less than 4 ha, and 3% own more than 10 ha. Hence, there is a scope and also challenge of mechanising all types and sized of land holdings in India. The agricultural production during 1951 and 1981 has increased from 55 million tonnes to 138 million tonnes. This is about 2.5 increase in about 30 years. This increase is a convenient one.

About two decades ago, animal power was the dominant source providing about half of the total farm power for Indian agriculture. Today, the mechanical combined with electric power has become the major source. The animal power and the human power are placed on second and third places respectively. A rough estimate indicates the distribution as indicated in Table 1.

TABLE 1. Sources of Agricultural Power in India.

S.N.	Source of Power	No. of units	Average unit h.p.	total power mill	% of total
1	Human	200	0.1	20	1.6
2	Animals	80 million	0.5	40	34
3	Tractors	0.63 million	32	20	16.5
4	Engines	4 million	5	20	16.5
5	E. Motors	5 million	4	20	16.5
Total				120	100.0

TABLE 2. Use of Improved Implements and Machines on Indian Farms.

S.N.	Type of Implements/machine	Number (approx.)	Size of Land Holding
1	Ploughs	30.0 million	True for all sized of farms
2	Seed drills	0.6 - 200 -	Generally above 4 ha
3	Threshers	0.3 - 200 -	Generally above 4 ha
4	Combines	2000 only	above 20 ha. or used on Govt. mechanized farms
5	Bullock Carts	13.0 million	all sizes of farms
6	Rice Mills	90725 only	These units range between 250 kg/hr to 4 tonnes/hr. Both privately cooperative owners.
7	Centrifugal Pump	7.0 million	Both electric and engine operated ones
8	Tractors	0.60 million	Tractor drawn. Two or four wheel type.
9	Tractor draw machines	1.0 million	All sizes to match the tractors.

From the tables 1 and 2, it is quite clear that the mechanisation has been taking place in India on almost all sizes of farms. The bullock operated improved implement are used by even small farmers. In many cases, they share the power and the implement with their neighbours on custom hire basis or on mutual exchange basis. The use of tractor power, the threshers and even the transport trailer is becoming very common between the small and large farmers.

2. Farm Industry

The Indian farm industry, created to serve the farmers and conscious of its mission to upgrade the quality of life in the villages, has been playing a key role in this direction. The products of this industry are helping to raise production and productivity without causing new social tensions of labour displacement. In fact, these equipment are raising the earnings of the rural community, adding new avenues of income, simultaneously providing more comfortable working environments. The progress of farm industry, thus presents a true measure of rural progress. The agricultural equipment industry is lead by the tractor industry and it has been registering a steady growth - both qualitatively and quantitatively. Commencing with a production of 880 tractors in 1961-62, eleven manufacturers produced 62,300 tractors in 1979-80, which exceeded 70,000 units in 1980-81 against the licensed capacity of 1,10,000 units a year. Two more units are licenced to produce 17,000 tractors per year. There are seven firms manufacturing power tillers in India.

Today, India offers more than 20 models of tractors between 18 and 75 hp range. The life and the performance of these tractors compare favourably with those of the rest of the world. The farm industry made another giant leap with introducing the Indian engineers.

Each tractor generates the demand for a variety of equipment - liek ploughs, tillers, disk harrows, seed drills etc. Considering an average of 1.5 implements and 0.8 trailer per tractor, more than 90,000 implements and about 50,000 trailers would have been sold in 1979-82.

TABLE 3. Units Engaged in Manufacture of Agricultural Machines in India.

S.N.	Type of Machines	Number of Manufacturers	Annual Production
1	Pumps	400	700,000 units
2	Engines	800	400,000 units
3	Electric motors	500	400,000
4	Tractors and Power tillers	13 + 7	80,000 + 3000
5	Small implements and tools	3,300	Millions of indigenous tools, ploughs, sicles etc.
6	Village artisans	500,000	Produce and repair indigenous plough and hand tools
7	Ancillary Units	3,000	Pro it various components to the large manufactures.

3. Investments

It is estimated that the annual investments in the farm machinery industry amounts to Rs 600 million in tractors, Rs 500 million in pump sets, Rs 300 million in engines, Rs 600 million in other implement and machines. The total will work out as Rs 2,000 million investment per year.

According to an Agricultural Refinance and Development Corporation estimates, the demand for pump sets alone during 1978-83 would be 3 million units. Of these, 1-2 mill. diesel sets and 1.8 mill. electric pumpsets. These figures include the units to be newly installed and as replacement of worn-out electric pump sets. However, the Planning Commission had earlier estimated a total demand of 3.5 million units during the same period. Rath Committee comprising of 11 members has estimated a total loan finance requirement of Rs 10,000 million during 1973-83. The Committee also estimated that the demand of the pump sets may go as high as 4.4 million sets by 1983.

4. Man Power Development

India made a great deal of developments in so far as the manpower development and technical training programmes are concerned. Table 4 presents the up to date picture of such a capability. In my opinion, the trained manpower has been responsible for increasing the agricultural production and productivity, increasing the agricultural mechanization, and transferring the improved technology among the farmers, industrial units as well as village artisans. We as a nation are not fully satisfied with our 'Village Extension' and 'Industrial Extension' programmes. Presently more emphasis is being given on these two programmes by state and Central Governments. Even though India has the most organised set up for the transfer of technologies, a lot more is yet to be done.

It would not be out of place to mention that the Indian Council of Agricultural Research (ICAR) through its National Research Institutes, Agricultural Universities, Trainers Training Centres, Farmers Training Centres, Coordinated Research Schemes, Land to Lab Programmes and similar other programmes have been instrumental in the process of this transformation. Recently, the Minister of Agriculture, GOI, has emphasized that the ICAR should take up the extension activities along with agricultural development department of GOI.

The establishments of Indian Institutes of Technology (IIT), Tractor Testing and Training Centres, Industrial Training Institutes, Small Scale Industries Institutes, Engineering Polytechniques, the Central Mechanical Engineering Institute and Indian Standard Institution has also contributed in the process of agricultural mechanization. Few indigenously developed agricultural machines were developed in these Institutes. Today more than 120 Indian standards on agricultural implements exist for the benefit of manufactures. The roles of voluntary organisations, the tractor manufacturers and the state department of agriculture have in no way less effective in this process. Also the national societies and associations have been instrumental in enhancement of agricultural mechanisation. The Indian Society of Agricultural Engineers, the Tractor Manufacturers Associations, the Pump Manufacturers Associations and so on made significant contribution during the last 20 years.

TABLE 4. List of Technical Organisations, Institutes and Intake Capacities.

S.N.	Type of Research and Training Instit.	No. of Institutes	Annual Intake	Remarks
1	Agr.Universities and Agr. Colleges	23+ 40	8000 U.G. 3000 P.G.I.PhD	These are State Govt. controlled and privately managed
2	Agr. National Institute	39	200 UG and PG/PhD	Financed and controlled by ICAR
3	Engg. Institutes	153	25000 U.G. 2000 P.G./PhD	Government privately controlled
4	Polytechnics	(1) Men 291 (2) Women 24	50000	Controlled State Technical Education Directorates
5	Appretinceship			
	(i) Graduate Level	(i) 13,200		Both Government and private industries offer the facilities
	(ii) Diploma Level	(ii) 17,200		
	(iii) Craftsmen	(iii) 123,000		

5. Conclusions

1. Agricultural Mechanisation is a must for all the countries of the world to remove drudgery and to increase the productivity.
2. Mechanisation will normally be a slow process, but
3. Trained manpower, demonstration farms, well organised agricultural machinery extension programmes are the essential inputs for the process of mechanisation.
4. Industrial extension, subsidy for motivation and loans on soft terms will be desirable to enhance the rate.
5. Training of village artisans and rural youth, men and women accelerate the process.
6. National policies and goals as well as international cooperation will always act as catalyst to accelerate the power.

