

## Mechanization of Agriculture

(\*Summary of Some Papers contributed to the  
Agricultural Economic Conference, Hyderabad, December 1948).

Dr. V. V. Sayyanna (School of Economics and Sociology, Bombay) read a paper, showing the progress of machanization in agriculture in countries abroad, in most cases up to 1940. In the wheat belt of U. S. A. almost every farm had one tractor at least, and there were more than one in many cases. The value of the mechanical equipment increased by  $2\frac{1}{2}$  times between 1910 and 1930, when it was estimated at 3,300 million dollars. Under the Rural Electrification Adminstration electrical service on co-operative lines expanded in rural areas in the U. S. A. When the R. E. A. was established in 1935 only 10 percent of farms were electrically equipped. There were in 1940 June 617 co-operatives sponsored by R. E. A. It was proved that electricity could be supplied at reasonable rates in rural areas for running agricultural machinery as well as for domestic lighting and other amenities.

The U. S. S. R. had adopted machinery in her collective farms, for ploughing, sowing, threshing and harvesting on an unprecedented scale. They were supplied and repaired at the State machine tractor stations. In the prewar year 23 million hectares were ploughed, 56 million hectatares were sown and 45 million hectares were harvested by machinery.

Mechanization appears best suited to large farms, but of late there has been a movement for extending such benefits to small and medium sized farms. Manufacturers are turning out machines suited to the technical and economic needs of small holdings. Researches are directed to the construction of multi purpose tractors at moderate prices which can cater to several requirements of farmers. Co-operatives are being established among small farmers for purchase and use of machinery in common. Just before the war there were 30,000 general agricultural co-operatives doing this service in Europe. Besides there were a number of special societies formed for the purpose in Scandinavian and Baltic countries. The State subsidised the manufacturers and users of small machines.

In India so far mechanised cultivation has been attempted only by a few land owners in Gujarat, Karnatak, Central Provinces, North Bihar and Orissa. There was no planned or definite effort by individuals, private bodies or Government, to encourage the use of machinery. The attempt to use machinery on large scale is the by product of 'Grow More Food Campaign'. In 1948, 300 tractors were received from abroad and 200 more were expected from U. S. A. and U. K.

\* By Mr. K. C. Ramakrishnan, who attended the Conference.



Besides, the Government of India had obtained from the U. S. surplus stores, 300 tractors, most of which have been distributed to scarcity provinces and states. In the United Provinces 45,000 acres of waste land were reclaimed. The Central Provinces Government have planned to clear 100,000 acres of *kans* infested land to bring it under wheat. The Government have decided to open a few tractor stations and make tractors available for ploughing fields at Rs. 20 per acre. In the East Punjab, large scale mechanical cultivation is being encouraged for rehabilitation of refugees from West Punjab.

The Ministry of Food and Agriculture of the Government of India have drawn up a six year plan of land reclamation with the help of the tractors now in hand and by importing 1000 tractors during the next three years. Nearly six million acres of cultivable waste land can be brought under cultivation, which may add only about 2 million tons of food grains annually to India's food resources. Still there will be a shortage of one million tons to the target of 3 million tons set up by the Food Grains Policy Committee. In order to reach this figure, approximately 10 million acres of cultivable land will have to be reclaimed. Here is a rough estimate of the areas available.

Assam	...	4 million acres.	Malva Union	...	1 million acres.
Orissa	...	1 „ „	Vindhya Union	...	500,000 acres.
Madras Agency	1	„ „	East Punjab	...	500,000 „
United Provinces	1	„ „	Berar	...	200,000 „

Mr. R. S. Basrur Mechanical Cultivation Engineer to the Government of Bombay, contributed a short note on the achievement of his section up to the end of October 1948.

Deep Ploughing	...	26,000 acres.	Terracing	...	200,000 feet.
Shallow Ploughing	...	76,000 „	Grading	...	1,500 hrs.
Harrowing	...	6,000 „	Bunding	...	100 „

Deep ploughing work is undertaken for eradication of weeds and reclamation of waste lands. Shallow ploughing was undertaken only when deep ploughing work was not available.

In his opinion, success of mechanization depends on (1) concentration of work, (2) maximum period of tractor operation in an area in a season and (3) minimum wastage on movements. Deep ploughing work in some areas in Karnatak and Khandesh almost gives these ideal conditions. In Karnatak tractors are employed from October to April on weed eradication work; and from May to mid-June on seasonal ploughing. Larger holdings give better ploughing results with the tractor. This type of work should be enforced by law on cultivators who have *hariali* infested areas.



Employment of tractors only on seasonal ploughing in areas entirely reliant on monsoon is not an economic proposition. The ploughing season in such areas is short, and the requirements of cultivation cannot be fulfilled unless a very large fleet is maintained in that area, which would be idle for a major part of the year and result in heavy overhead expenses. This can be minimised to some extent, if units of 200 tractors are handled by a large number of co-operative societies in the area. These tractor units, with power attachments, can be employed for pumping thrashing and transport purposes during slack season. Tractors on unirrigated tracts can be employed on seasonal ploughing practically throughout the year in areas like Belapur, Kopergaon can be undertaken as a succesful commercial enterprise.

In districts which have small holdings and very short ploughing season, it is not economic to run tractors. Mechanical cultivation has a bright future in about 10 districts of Bombay. Tractor units should be mobile and operate according to the demand of the public. The size of a unit should be 6 to 8 tractors and each should be self-sufficient for repair, maintenance etc. Government tractors should be employed in the reclamation and eradication of weeds only. Seasonal ploughing should be entrusted to private bodies and individuals, who may be encouraged by the provision of timely technical assistance, supply of spare parts, oils and lubricants. Owners should be given some technical training, so as not to rely too much on unscrupulous drivers.

On the question of a large number of light tractors or a small number of heavy tractors, the former is preferred on the score that in the event of a casualty, percentage of efficiency of the whole unit is not affected markedly and capital cost is much less. As against this, overhead charges, compared with heavier tractors for the same capacity, are heavy. Much depends on the agronomical features of the areas, e.g. it is advisable to use lighter tractors in Konkan districts, where individual holdings are small. Heavier tractors do better in an area of large holdings.

Mr. M. C. Dutt, Agricultural Engineer, Assam, had a brief note.

*Reclamation of waste lands.* Assam provides enormous scope for extension of cultivation on virgin lands. People are too poor to buy machinery and implements. The Government of Assam has chalked out plans to help the cultivators, organised in co-operative societies, by supplying them with tractors and implements at scheduled rates for ploughing and harrowing the lands. The Government has decided to establish a central workshop and two mobile workshops with all facilities for repairs and maintenance and advice.



Heavy tractors are used in reclamation of land with medium depth of ploughing so as to protect the land from heavy soil erosion. Bull-dozers are proposed to be employed to clear light forests, and graders on highly undulated lands. It is also proposed to put in contour bunds for safeguarding against erosion.

*Mechanical cultivation of arable land.* Shortage of labour has rendered cost of cultivation very heavy. Uneven rainfall leads to untimely operation in agriculture and subsequent damage to crops and poor out-turn. The soil gets hardened up which the country plough cannot tackle. The need to employ machinery for breaking up the soil quickly has been felt.

The Department of Agriculture has in the period of 6 months opened up 3 projects in the Province. The task of organisation and operation has been difficult, as the spirit of co-operation has still to be infused among farmers. Up to the end of October, only 27,000 acres have been cultivated. Operations are proceeding in other areas and about 5,000 acres more will be added in the course of the year 1948.

Mr. V. Subbarajan, Engineer, Hyderabad (Deccan) stated :—

The items that have to be taken into account for examining the economic aspect of mechanization are :—

1. Interest and depreciation.
2. Running expenses,
3. Cost of repair and service.
4. Miscellaneous charges such as transport etc.

As mechanization should be adopted only for certain agricultural operations, the comparison of costs will be limited to the following.

Tractor and bullock or manual power for land development and also for annual ploughing on large estates.

*Tractor power versus bullock or manual labour.*

The useful life of a tractor under field conditions may be taken at 10,000 hours of five years with 2,000 hours of working per year. On this basis the rate of depreciation will be 20 percent. The interest on capital outlay may be taken at 4 percent. Considering a 10 H. P. tractor attached with necessary ploughing equipment the cost of work will be as follows. The cost of the tractor with plough outfit will be about Rs. 35,000.

1. Interest and Depreciation per hour  
at 4 per cent and 20 per cent per  
year of 2,000 hours respectively on  
Rs. 35,000.

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2. Running expenses per hour :		
5 gallons of H. S. Diesel Oil at		
Rs. 1—8—0 per gallon.	Rs. 7—8—0	
1 gallon of lubricant	3—8—0	
Grease 2 Lbs.	2—0—0	
Cotton waste	0—1—0	
		13—8—0
3. Cost of repair and service per hour		2—0—0
4. Labour and supervision charges per		
hour: Driver	0—8—0	
Cleaner	0—2—0	
Supervisory and service staff	0—8—0	
		1—2—0
5. Miscellaneous expenses per hour		1—0—0
		21—13—3
	Total cost per hour	

A tractor of this type can plough  $\frac{3}{4}$ th of an acre in one hour in hard clay soils to a depth of 12" to 14". The cost per acre works out at Rs. 29—1—8, or say Rs. 29. The cost per horse-power hour works out to Rs. 0—3—6. If the same work has to be done by digging by manual power, the cost will be as follows:—

The total excavation on one acre to a depth of one foot will be 43,560 cubic feet and the cost of excavation at Rs. 0—8—0 per 100 cu. ft. will be Rs. 217 —8—0 as against Rs. 29 by tractor.

An average person is expected to develop 1/10th horse power. At Rs. 1—4—0 wages for one day of 8 hours working, the cost of horse-power by manual labour works out to Rs. 1—9—0 as against Rs. 0—3—6 by tractor. Thus it will be seen that work by tractor will cost only 1/7 of what it will cost if the work is done by manual labour. It may be noted that bullock power is of no use for deep ploughing in black cotton soils infested with weeds, where hand digging or tractor ploughing is the only solution. Similarly in developed areas the cost of ploughing by tractors can be compared with that by bullock power. A pair of bullocks is expected to develop one horse-power. For shallow ploughing in medium soils, 40 H. P. tractor is considered suitable. To do the same job as a tractor of 40 H.P., 40 pairs of bullocks are required. In the appendix details of cost comparison are given, from which it will be seen that for ploughing 6" to 8" in medium soils, it will cost Rs. 7—8—0 per acre by tractor and Rs. 11 per acre by bullock power. Thus farm work is definitely cheaper by tractor than by manual or bullock power.



The tractors can be utilised actively for a period of 8 months, from November to June. During the period when ploughing is not possible, the tractors could be utilized for stationary purposes. The tractors are extremely adaptable power units and power may be delivered at drawbar, at a belt pulley or at the special power take off. As a stationary engine, it can be utilized for pumping, crushing and similar jobs.

## APPENDIX

*Comparison of costs by Tractors and Bullock Power.*

S. No.	Particulars.	Ploughing by a H. P. tractor with Mould Board Plough.	Ploughing with 40 Pairs of bullocks equivalent to 40 H. P.
1. Capital outlay		Tractor and implements Rs. 25,000	at 400 each bullock Rs. 32,000
2. Depreciation per year		5 years life Rs. 5,000	10 year life Rs. 3,200
3. Interest		4% Rs. 1,000	4% Rs. 1,280
4. Running expenses		Cost per hour :—  2 gallons fuel oil Rs. 3-0-0  $\frac{1}{2}$ gallon lubrication 1-12-0  1 lb grease 1-0-0  Cotton waste 0-8-0  <hr/> Cost per hr. 6-4-0  per year of 2,000 hours of working Rs. 12,500	Fodder @ 40 per month per pair of bullocks and per year for 40 pairs Rs. 19,200
5. Repair		@ Re. 1/- per hour & for 2,000 hours of working in a year Rs. 2, 2,000	@ Rs. 10 per set of implements and 40 sets Rs. 400
6. Labour charges		Driver @ Rs. 90/- P. M. & cleaner at Rs. 30/- P. M. per year Rs. 1,440	30 men for 8 months 10 men 12 months at Rs. 25/- P. M. Rs. 9,000

Total  
per per  
interest  
tion ru  
repair  
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output

Cost

Cost



No. Particulars.	Ploughing by a H. P. tractor with Mould Board Plough.	Ploughing with 40 Pairs of bullocks equivalent to 40 H. P.
Total operating costs per per year including interest and depreciation running expenses, repair and labour charges.	Rs. 21,940	Rs. 33,000
Total anticipated output of work	at 1½ acres per hour & for at 2,000 hours of working in a year Rs. 3,000-acres.	Rs. 3,000
Cost per acre	Rs. 7.31 or say Rs. 7-8-0 per acre.	Rs. 11.03 or say Rs. 11-0-0 per acre.
Cost per horse power	Rs. 0-4-6.	Rs. 0-6-8

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