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To Identify the Operation/ Equipment Needing Improvement and Suggest Strategy for Appropriate Mechanization in India

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A B S T R A C T

Economic growth in India agricultural sector lags behind growth in industry and services, creating an ever widening rural-urban income gap. Agricultural mechanization plays a key role in improving agricultural production and productivity in developing countries. The average farm size in India is small 1.16 hand small and marginal land holdings less than 2.0 ha account for 85% of land holdings. Mechanization small and non-contiguous group of small farms is against economics of scale for individual ownership of farm machinery. The status of farm mechanization in India is analyzed by the trend in growth of mechanically power- operated farm equipment over traditional human and animal power operated equipment. It was observed that there was a direct correlation between farm-power availability and productivity during the past six decades. Haryana state of India has the highest tractor density per thousand hectare of net sown area of 84 tractors and followed by 76 tractors for Punjab against all India average of 33 tractors. The sale of transplanter, power weeder, combine harvesters, rotavator and thresher in India is growing at a compound annual growth rate CAGR of 50,50,28,20 and 10% respectively. The available farm power and productivity in India are expected to reach 2.2kW/ha and 2.3kW/ha, respectively by the year 2020.

Introduction

Most developing countries are primarily agrarian societies in which agriculture is the main source of wealth. Thus, an increase in agricultural productivity is the primary requirement for setting the whole rural development process in motion, and fir the overall economic development of these countries. However, agricultural development alone. It encompasses all the people and resources in the rural setting and emphasizes improvement in the level of living of the rural poor and involvement of all rural people in

the development process, with the ultimate aims of reducing hunger of improving the quality of life. By the end of this century world population will surpass 6 billion, against less than 3 billion twenty year ago and 4.3 billion today. The present productive capacity of farmers is just not adequate to feed this number of people. A substantial increase in agricultural productivity will be required to meet the future food needs of the world and, historically, such increases have been clearly linked with technological change including the introduction and application of higher level of agricultural mechanization.

Agriculture occupies the most important role in Indian economy. Earlier, Indian farmers largely relied upon the human and animal power. But with the passage of time, tractor and tractor driven agricultural implements have been introduced with the Government sponsored scheme. It has been observed that during the last 10 years, the concept of farm mechanization and its importance has been well accepted and accordingly new farm implement/ equipments have been developed and commercialized. This has resulted in increase of productivity and production to feel the over increasing population besides reduction in drudgery associated with farm operations. Farm mechanization has played a positive role in increasing employment in rural areas through generation of opportunities for operators, mechanics, salesman etc. The adoption of tractor and farm machinery/ implements has been very rapid in India with the assistance of centrally sponsored schemes but its spread has been uneven.

The Ministry of Agriculture and Farmers Welfare launched a scheme Sub- Mission on Agricultural minimization for promotion of farm mechanization during the year 2014-15. To evaluate the effectiveness and status of implementation with regard to physical and financial progress, mechanization strategies, extend of adoption of technologies and bottlenecks during the implementations of scheme for the year 2014-15, 2015-16 and 2016-17, WAPCOS Ltd., Gurugram has been awarded a project to conduct monitoring, evolution and impact assessment of SMAM.

Ojha and Srivastava (1987) discussed in this paper the present status and future trends of comparative demand and utilization of draft animals and tractors on Indian farms. Utilization of available farm power, economic and social restraints and economic aspects of hiring tractors, bullocks and power tillers are outlined and brief case studies of powered machinery use for cultivation are presented.

Shyam et al., (1987) reported the study result on energy requirements of potato cultivation for 3 levels of mechanization. The energy input from various power sources was approximately 50% higher in tractorized farming than on bullock-operated farms. The overall energy output to input ratio was approximately 14% higher for farms using animate power sources than on tractorized farms. It is suggested that using cattle dung as a partial substitute for fertilizers could promote energy savings only if it was passed through a biogas plant before used as a fertilizer.

Ehui and Polson (1993) have reported that with a limited number of cash cropping areas, sub-Saharan Africa has the lowest level of mechanization including animal-driven implements and use of tractors. In this paper previous research is reviewed to evaluate the economic and ecological constraints to animal draft cultivation. Results of past studies have shown that the animal-drawn plough is only profitable at higher intensities of farming induced by population growth and better market access. Utilization and use of animal driven implements will, however, be low in

areas characterized by light soils (arid zones) or areas prone to erosion, or with a short growing season. Other constraints on the profitable use of animal power are farmers' characteristics and policy factors. Farm and family size, the farmer's experience and types of equipment are shown to play important roles. One factor often ignored is the opportunity cost of labour and capital during off-farm activities.

Utilization of animal traction implies animal husbandry costs. If, however, the cost of maintaining the animal outside the peak season reduces off-farm income opportunities, farmers are not likely to make profitable use of the plough. Other opportunities available to the farmer (e.g. beef production when beef prices are high) are likely to have a negative impact on utilization of for cultivation.

Materials and Methods

Chhattisgarh state has been divided into three Agro-climatic zone viz. Chhattisgarh plains, Bastar Plateau and Northern Hill zone, covering 51.0%, 28.0% and 21.0% of the geographical area, respectively. The district from the Chhattisgarh plains was selected. Out of which two blocks namely Gunderdehi and Gurur block has been identified for the purpose of study. Two villages from each block were selected for conduction of data collection work. In this study 30 farmers including women from each of the village (total four) were interviewed personally for recording all necessary observation as per proforma developed.

Method of Data Collection

The data were collected through personal interview of the farmers and farmwomen on the pre – tested proforma (Appendix – A) by using recall method for all the selected farmers falling in different categories. The information about household activities was collected through interview of the counterparts of the farmers. Actual observations of some activities were also recorded during the field operations in a few villages. The time and labour required for various farm operations mainly field preparation, sowing, transplanting, irrigation, manuring, fertilizer application, weeding, plant protection, harvesting, threshing, drying and transportation were recorded for each crop under study on the basis of the verbal interview of the farmers. Thus the data in terms of time and labour required to accomplish different field operations and household activities along with other basic information were collected individually from all the selected farmers.

Data Processing

Adopting standard techniques suggested by the research workers the data thus collected was processed. First of all the data for animal power utilization was arranged separately for different categories of respondents for each village. The values thus found were arranged in tabular form separately for each category of farmers.

Sampling Procedure

The main focus of study was on the animal power utilization, tractor power utilization and farm women and their involvement in agriculture and allied activities in the state. Therefore, only the draught animal, farm women and male farmers were considered separately for the study. To identify the location of survey sites in the selected district of the zone villages were grouped block – wise. The farmers were selected randomly. After that population of the farmers were grouped under different categories for all the four villages. The categories viz. marginal (<1ha), small (1-2ha), semi-medium (2-4ha),

medium (4-6ha) and large (>6ha) of farmers, selected in each of the village.

Statistical Tools Used for the Analysis of Data

The frequency, percentage, mean and standard deviation were calculated for precise and meaning analysis and interpreting the data collected. Data were analyzed for the most part by using tabular form as for its inherent quality in portraying the true picture of farm women involvement in agriculture and allied activities in the state of Chhattisgarh. Farm women involvement was assessed as low level (< mean - SD), moderated level mean and high level (> mean + SD) as suggested by Roy and Pathak (2000).

Results and Discussion

Draught animal power utilization

Draught animal used in this region are small sized. The weight of a pair of He- buffaloes ranges between 550 to 900 kg. The draught animals are primarily used for field preparation, basic operation, threshing and transportation (*Jogdand et al., 2011*).

Population of draught animal power and use of implements

The summary of information collected about the sample villages viz. Arjunda, Sikosa, Latabod and Lohara. One hundred twenty farmers were randomly selected out of four villages. Distribution in four villages were uniform i.e. 30 farmers in each village having He-buffaloes as a source of farm power.

It is observed that the entire four villagers are more or less of the same category on the basis of number of farm families. In all the four villages He-buffaloes and tractor is available as source of farm power. The higher population of He-buffaloes compared to bullocks showed the popularity of He-buffaloes as a source of draught animal power. Few farmers have installed diesel engine and electric motor for lifting water. Highest number of diesel engine and electric pump has been recorded in village Latabod. The overall population of different animal drawn implement has also been recorded. Under animal drawn category, all are of traditional type except few farmer who have improved plough i.e. tendua plough.

Population of power source in selected village

Month wise utilization of He-buffaloes power

The month wise He-buffaloes power utilization for four villages from May 2011 to April 2012 is given in Appendix B to Appendix E. It was observed that the May, June, July and August months shows a rise in draught power utilization due to time of tillage and intercultural operation for paddy crop, He-buffaloes power utilization was confined for transportation in October and November.

The utilization in the month of December and January is mainly for threshing operation just after the harvest of paddy. The he-buffalos are mostly unutilized in the month of February March and April due to monocrop nature of the area .

Implement wise utilization of He-buffaloes power

The annual utilization of different implements/operations were also recorded and it was found that in all the four villages the maximum utilization was noted for plough (Arjunda 3893h, Sikosa 3505h, Latabod

5187h, Lohara 5685h) followed by carting (Arjunda 1506h, Sikosa 2294h, Latabod 2442h, Lohara 3019h), leveling by wooden plank (Arjunda 918, Sikosa 790h, Latabod 1234h, Lohara 1009h) and animal treading (Arjunda 422h, Sikosa 390h, Latabod787h, Lohara 563h). The highest total annual utilization of He-buffaloes power was noted in village Lohara and it was 10276 h and lowest was 6739 h in village Arjunda. The other villages observed the value of 9650 h and 6979 h for Jarve (Ch) and Sikosa respectively. The highest utilization of He-buffaloes power use/ha was noted in village Lohara and it was 118.556 h/ha and lowest was 50.26 h/ha in village Sikosa. The other villages observed the value of 111.68 h/ha and 106.36 h/ha for Arjunda and Latabod respectively.

Table.1

S.no.	Particulars	Gunderdehi Block		Gurur Block	
		Arjunda	**Lohara**	**Sikosa**	Latabod
1	Total Area (ha)	537.452	569.398	586.621	687.907
2	Cultivable Area (ha)	409.314	422.153	439.900	542.923
3	Irrigated Area (ha)	409.314	422.000	427.000	405.000
4	Major Crop Grown				
	(a) Kharif	Paddy, Arhar			
	(b) Rabi	Wheat, Bengal Gram, Sarso, Tiwra, Alsi			
5	Major Crop Rotation	Paddy, Wheat, Moong			
6	No. of Farm families	342	408	482	805
7	Bullocks (Nos.)	10	16	138	193
8	He-buffaloes (Nos.)	200	250	240	316
9	Tractors (Nos.)	9	14	22	9
10	Power Tiller Reaper (Nos.)	2	3	3	0
11	Country Plough (Nos.)	105	256	327	342
12	Bollock Cart (Nos.)	104	254	322	340
13	Gobar Gas Plant (Nos.)	8	0	7	36
14	Vermi Compost (Nos.)	10	0	0	0
15	Tube Well (Nos.)	7	2	6	4
16	Electric Motor (Nos.)	20	30	11	5
17	Diesel Engines (Nos.)	30	70	9	16

Table.2 Average utilization of He-buffaloes power (h)

S. No.	Name of Village	Area (ha)	No. of Draft Pair	Implementwise Utilization				Total Utilization (h)	Utilization /Pair (h)	Use/ha
				Plough (%)	Woonn Plank (%)	Threshing (%)	Carting (%)			
1	Arjunda	46.86	30	3893	918	422	1506	6739	224.6	111.68
				57.77	13.62	6.26	22.34			
2	Sikosa	93.23	33	3505	790	390	2294	6979	211.5	50.26
				50.22	11.32	5.59	32.87			
3	Latabod	67.77	32	5187	1234	787	2442	9650	301.6	106.36
				53.75	12.79	8.16	25.30			
4	Lohara	61.21	30	5685	1009	563	3019	10276	342.5	118.56
				55.33	9.82	5.48	29.38			

Table.3 Animal drawn implements

S.No	Name of implement
1.	Mould board plough
2.	Tendua plough
3.	Biasi plough
4.	Indira seed drill
5.	Paddy puddler
6.	Harrow patela

Table.4

	Tractor use in different agricultural operation	Average annual agril. use of tractor for personal land (h) (%)	Average annual agril. use of tractor for custom service land (h) (%)	Average annual other use of tractor for custom service (h) (%)
1.	Tillage	56	42	-----
		(14.66%)	(10.99%)	
2.	Sowing	30	37	-----
		(7.85%)	(9.69%)	
3.	Leveling	4	9	-----
		(1.05%)	(2.36%)	
4.	Threshing	20	37	-----
		(5.24%)	(9.69%)	
5.	Transportation	32	39	-----
		(8.38%)	(10.21%)	
6.	Irrigation	-----	3	-----
			(0.79%)	
7.	Annual	14	-----	59
	miscellaneous use	(3.66%)		(15.45%)
	Total	156	167	59
		(40.85%)	(43.72%)	(15.45%)

Table.5

S.No	Tractor used in different agrl. operation	Average Annual agril. Use of tractor for personal land H (%)	Average Annual agril. Use of tractor for custom service land (%)	Average annual other use of tractor for custom service(%)
1.	Tillage	56 10.66	42 10.99	----
2.	Sowing	30 (7.85 %)	37	-----
3.	Leveling	4 1.05	9 2.36	----
4.	Threshing	20 5.24	37 9.69	----
5.	Transportation	32 8.38	39 10.21	----
6.	Irrigation	----	3 0.79	----
7.	Miscellaneous use	14 3.66	------	59 15.45
	Total	156 40.85	167 43.72	59 15.45

Table.6 Tractor drawn implements

S.No.	Name of implement
1.	MB Plough
2.	Harrow puddler
3.	Cultivator
4.	Rotavator
5.	Disc harrow
6.	Cultivator cum seed drill
7.	Seed cum fertilizer drill
8.	Zero till seed drill
9.	Frount mounted reaper
10.	Paddy thresher

Utilization pattern of farm tractors

Utilization pattern of farm tractors in different agricultural operations for own land and for custom service in rabi and Kharif season which revealed that the average annual use of the tractors was 382 h only in the district out of which for 59.16% of the time, the tractors were used for custom work and that of 40.85% of the time, for own work.

Maximum use of the tractor for 98 h (25.65%) was recorded in tillage operation, followed by threshing operation 57 h (14.92%) and sowing operation 67 h (17.53%).In the custom work, the maximum use of the tractors was found in tillage and transportation operations 42 h (10.99%) and 39 h (10.21%), whereas for own work, maximum use of the tractor was found was found in tillage operation (14.66%).

Agricultural mechanization is at a very low level in the region and this leads to the following consequences with respect to agriculture for development

The very low levels of mechanization coupled with equally low utilization of the productivity-enhancing inputs such as improved seeds, fertilizers and improved water management for agriculture, makes small and medium scale farming unattractive to the youth who make up the bulk of the population in the region.

For those who remain behind in the rural areas, the extremely low productivity makes farming poverty terrapin which the majority can hardly produce enough food to meet their minimum calories needs.

Therefore the, for the first time since the collapse of international commodity prices in the early 1970s, the three factors elaborated above come together to create real commercial opportunities for accelerated mechanization of small scale agriculture.

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