Effect of Farm Mechanization in Human Labour Employment

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Abstract: - Assam like other state of India, is predominantly an agricultural state. In the context of growing demand of selective forms of farm machinery in Assam, the pertinent question to ask is whether the farm mechanization contributes to income and employment of the farm families either by increasing productivity, intensity of cropping or by changing the cropping pattern . The study was conducted in Central Brahmaputra Valley and Upper Brahmaputra Valley Zone of Assam, India. The objective of the study is to examine the effect of mechanization on human labour employment .Primary data were collected with the help of specially design pretested schedule by interview method. Tabular, percent and linear regression analysis were done. Thus, a sample of 240 farmers had been taken for the study. The study found that labour employment per cropped hectare showed a declining trend with increase in farm group size under different categories of mechanized and Bullock Operated Farm. Again labour employment and farm size had inverse relationship within different categories of mechanized and Bullock Operated Farm. The inverse relationship hold true in case of operation like sowing, intercultural operation and irrigation. Hired labour had positive relationship with farm size in each categories of mechanized and Bullock Operated Farm and family labour had negative relationship with farm size within each categories of mechanized and Bullock Operated Farm.

Key-Words: - Mechanized, Bullock Operated Farm, labour employment, operation, hired labour, family labour, intercultural operation

1 Introduction

Assam like other state of India, is predominantly an agricultural state. However, development of agricultural sector is still less as compared to other states of the country. Mechanization has often been considered by the critics as detrimental for densely populated "labor surplus" countries as negative agricultural employment effects of mechanization in terms of displacement of labor and tenant farmers stated by Mansur Ahmed (2016) [1]. It has been felt that agricultural growth rate is increasing gradually in the state due to the high yielding varieties programs along with gradual shift in the modern technology but it is still less as compared to the other state. Berg et al. (2007) examined the impact of increasing farm size and mechanization on rural income and rice production in China. They reported that larger farm sizes labour constraints inhibit farmers from specialization in non-rice crops leads to rising per capita income [2]. In the context of growing demand of selective forms of farm machinery in Assam, the pertinent question to ask is whether the farm mechanization contributes to income and employment of the farm families either by increasing productivity, intensity of cropping or by changing the cropping pattern. Aijrangzeb, (2004) reported that additional invest on mechanization will comparatively yield better than

the manual labour [3].Unlike the other states, there has hardly been any study so far in the state of Assam to answer this question. Priyanka Upreti (2015) reported that farm mechanization is the ultimate control measure for food inflation for reducing the scarcity of labour [4]. The price distortion for tractor and equipment ,if accompanied y adjustment input prices with the world market is not likely affect the pace mechanization as reported by Amhed (1971) [5]. Hazarika (2015) also reported that Labour scarcity and farm mechanization needs to be studied in detail both at macro and micro level across various farm situations to verify whether there is any linkage between micro and macro level situation [6]. Ramya (2016) reported that farm mechanization increases on-farm human labour marginally, whereas the increase in off- farm labour such as industrial production of tractors and ancillaries was much more. That farm mechanization displaced animal power to the extent of 50 to 100% but resulted in lesser time for farm work [7]. Many findings revealed that farm mechanization had a tendency to replace human labour. Chidambarn, M. (2013) revealed that the component of machine labour was on the higher usage by the large farms while the small farms had used more of human labour [8]. Impact of mechanization on labour employment was

controversial issue particularly in labour surplus country like India. Large number of both types of farmers are neither completely mechanized nor completely non-mechanized. Majority of the farmers in each type of farmers do not have their own farming machines/animals. Per acre productivity of mechanized farmers is a little bit greater than the non-mechanized farmers as reported by Rahman et.al [9]. However, different studies also indicated displacement of human labour in agricultural operations was non-significant and it was neutralized by increased demand for human labour due to multiple cropping, greater intensity of cultivation and ultimately getting more income. Sinaga,S. R.(2006) descried in this study that in Indonesia ,Agricultural mechanization is beginning to bring far reaching changes in farming system as well as structure and answer some questions of the changing scenario [10]. Further, it has been argued that application of farm mechanization will adversely affect the labour requirement, which would adversely affect the exiting employment situation. Therefore present study was therefore an attempt to answer the aspects of farm mechanization in Assam.

2 Problem Formulation

The present study is an attempt to study the status of farm mechanization, effect of mechanization on human labour employment of the sample farms.

2.1 Study Area and Selection of Samples

The study was conducted in Upper Brahmaputra and Central Brahmaputra Valley Zone of Assam. The sampling design followed for the study was four stage random sampling design. Districts from the first stage unit, blocks were the second stage unit, villages were the third and the sample farmers were the fourth ultimate stage of units of sampling. For Central Brahmaputra Valley Zone, Nagoan district had been selected as Nagaon district is ahead of mechanization compared to other districts. Dibrugarh and Jorhat district represented the Upper Brahmaputra Valley Zone. In consultation with Agricultural Development Officer (ADO) and Agricultural Engineering Department, Government of Assam in the selected districts, the blocks having higher concentration of farm implements were selected. The sample household were classified into 5 sub groups viz., Tractor Ownership Farm (TOF), Tractor Hired Farm (THF), Power Tiller Ownership Farm (PTOF), Power Tiller Hired Farm(PTHF),

Bullock Operated Farm(BOF). Most of the farmers in the sample were having less operational holding as most of the farmers of Assam is small and marginal. Only very few farmers were found to have land holding more than 3 hectares hence the stratification of groupings were made as follows:

i)   Group I (less than 1.00 ha)
ii)   Group II (1.00-2.00 ha) and
iii)   Group III (more than 2.00 ha)

Thus, a sample of 240 farmers comprising of 120 from Upper Brahmaputra Valley Zone and 120 from Central Brahmaputra Valley Zone had been taken for the study.

2.2 Data collection

Both primary and secondary data were used for the study. Secondary data were collected from different published sources and government institutions and primary data were collected from 240 sample farms by personal interview method with the help of specially designed pretested schedule for various objectives of the study purpose. All data collected from sample farms pertains to the year 2014-15.

2.3 Analysis of Data

Tabular with averages and percentage, log linear regression analysis were carried out to find out the effect of farm mechanization on income, employment in study. Again for analytical tool the total utilization for each enterprise was calculated in terms of adult man days of eight hours of work per day. In case of women and child labour, in converting to standard man equivalent, a ratio of one (1) women labour is equal to 0.5 adult male labour and one (1) child labour is equal to 0.75 adult male labour was used.

3 Problem Solution

3.1 Human Labour Employment per Cropped Hectare

The human labour employment per hectare of different size group under various categories of mechanized and Bullock Operated Farm are presented in Table 1. From the table it was revealed that average labour employment per cropped hectare were 53.36,70.04,68.87,87.45 and 147.9 man days for Tractor Ownership Farm, Tractor

Hired Farm, Power Tiller Ownership Farm, Power Tiller Hired Farm and Bullock Operated Farm, respectively. Human labour employment per cropped hectare in the study area was lower in case of mechanized farm than Bullock Operated Farm. This was in showed contradiction with the findings stated by Verma (2006) that effect of mechanization on labour employment was positive and reduction in labour use in case of Tractor Operated Farm was quite nominal.

Thus, it clearly indicated that displacement of labour occurs with the increasing level of mechanization [11]. Agarwal, B. (1981) had taken the account of fact of that mechanization is and mixed package instead of principal effect of tractor on total farm employment [12]. Labour displacement was highest in case Tractor Ownership Farm where employment of labour was 36.08 percent followed by Power Tiller Ownership Farm which was 46.57 per cent.

extent. In case of transplanting both mechanized and Bullock Operated Farm labour employment was Labour employment per cropped hectare showed a declining trend with increase in farm group size under different categories of mechanized and Bullock Operated Farm. In the case of Tractor Hired Farm, labour employment were 71.94, 67.51 and 62.79 man days in Group I, Group II and Group III, respectively. Similar trend was also seen in case of other categories of farms thus indicated negative relationship between farm size and human labour employment. The findings is in conformity with the findings of that less number of labour per hectare is required to complete the production process by mechanized farm compared to traditional farm. Family labour is mostly affected by the mechanization. Animal power and output have positive effect on labour requirement, while power tiller and input costs have adverse effect on labour requirement for wheat cultivation M. S.

Table 1: Human labour employment per cropped hectare under various categories of Mechanized and Bullock Operated Farm across different farm sizes (man days)

Farm Size	TOF	THF	PTOF	PTHF	BOF
Group I	-	71.94	-	89.2	147.09
		(48.91)		(60.64)	(100.00)
Group II	-	67.51	68.76	84.89	150.03
		(45.00)	(45.83)	(56.58)	(100.00)
Group III	53.36	62.79	68.97	-	-
Average	53.36	70.04	68.87	87.45	147.9
	(36.08)	(47.36)	(46.57)	(59.13)	(100.00)

Figures within parentheses indicate percentages expressed in terms of respective Bullock Operated Far

TOF : Tractor Ownership Farm   THF : Tractor Hired Farm   PTOF : Power Tiller Ownership Farm
PTHF : Power Tiller Hired Farm   BOF : Bullock Operated Farm

3.2 Operation Wise Human Labour Employment per Cropped Hectare

Operation wise human labour employment per cropped hectare for different categories of mechanized and Bullock Operated Farm is given in Table 2. and revealed that human labour employment was less in case of mechanized farm than Bullock Operated Farm such as ploughing, harvesting threshing and transportation and on the other hand, labour employment was found to be more in all mechanized farm than Bullock Operated Farm for operation such as manuring, fertilization, intercultural operation and irrigation which indicated higher consumption of material inputs in turn resulted in greater productivity and thereby greater use of labour and neutralize labour displacement effect of mechanization up to some

almost same due to the reason transplanting was done by traditional method where no machine was used in the study area.

Operation wise human labour employment of different size group under different categories of mechanized and Bullock Operated Farmare presented in Table 3 and revealed that the labour employment and farm size had inverse relationship within different categories of mechanized and Bullock Operated Farm. This result is in conformity with the finding of Bordoloi (1992) that farm mechanization has negative impact on labour employment in Titabar district of Assam. [14] Similarly Lim(1982) reported that mechanization requires fewer laour inputs and present the potential of releasing labour which can be used for other works [15]. The inverse relationship hold true in case of operation like sowing, intercultural operation and irrigation. This might be due to

variation in the cropping pattern amongst different size group under different categories of mechanized and Bullock Operated Farm.

Table 2. Operation wise human labour employment per cropped hectare under various categories of Mechanized and Bullock Operated Farm (mandays)

Categories of farms	A	B	C	D	E	F	G	H	Total
TOF	15.99	4.15	19.95	.93	.92	.47	6.79	4.36	53.36
	(29.97)	(7.78)	(37.39)	(1.74)	(1.72)	(0.88)	(12.72)	(8.17)	(100.00)
THF	16.49	4.67	20.26	1.27	1.13	.85	17.05	8.32	70.04
	(23.54)	(6.67)	(28.93)	(1.81)	(1.61)	(1.21)	(24.34)	(11.88)	(100.00)
PTOF	26.54	4.55	20.28	1.16	1.17	.49	9.92	4.76	68.87
	(38.54)	(6.61)	(29.45)	(1.68)	(1.70)	(0.71)	(14.40)	(6.91)	(100.00)
PTHF	28.54	4.95	20.65	1.45	1.14	.85	18.85	11.03	87.45
	(32.64)	(5.66)	(23.61)	(1.66)	(1.30)	(0.97)	(21.56)	(12.61)	(100.00)
BOF	71.14	1.03	20.24	1.17	.312	-	31.50	22.53	147.90
	(48.10)	(0.70)	(13.68)	(0.79)	(0.21)		(21.30)	(15.23)	(100.00)

Figures within parentheses indicate percentage of the total

(A=Ploughing, B=Manuring & fertilization, C=Transplanting, D=Sowing, E=Intercultural& irrigation, F=Earthing up, G=Harvesting, H=Threshing & transportation)

Table 3. Operation wise human labour employment per cropped hectare under various categories of Mechanized and Bullock Operated Farm across different farm sizes (man days)

Categories of farms	Farm size	A	B	C	D	E	F	G	H	Total
TOF	Group III	15.99	4.15	19.95	.93	.92	.47	6.79	4.36	53.56
		(29.85)	(7.75)	(37.25)	(1.74)	(1.72)	(0.88)	(12.68)	(8.14)	(100.00)
THF	Group I	16.75	4.79	20.33	1.31	1.1	.87	18.12	8.67	71.94
		(23.28)	(6.66)	(28.26)	(1.82)	(1.53)	(1.21)	(25.19)	(12.05)	(100.00)
	Group II	16.10	4.52	20.18	1.25	1.21	.82	15.63	7.80	67.51
		(23.85)	(6.70)	(29.89)	(1.85)	(1.79)	(1.21)	(23.15)	(11.55)	(100.00)
	Group III	15.87	4.12	19.85	.95	1.08	.75	12.91	7.26	62.79
		(25.27)	(6.56)	(31.61)	(1.51)	(1.72)	(1.19)	(20.56)	(11.56)	(100.00)
PTOF	Group II	26.25	4.82	20.45	1.31	1.25	.56	9.56	4.56	68.76
		(38.18)	(7.01)	(29.74)	(1.91)	(1.82)	(0.81)	(13.90)	(6.63)	(100.00)
	Group III	26.75	4.35	20.15	1.05	1.11	.44	10.2	4.92	68.97
		(38.78)	(6.31)	(29.22)	(1.52)	(1.61)	(0.64)	(14.79)	(7.13)	(100.00)
PTHF	Group I	28.92	4.99	20.88	1.49	1.09	.81	19.22	11.80	89.2
		(32.42)	(5.59)	(23.41)	(1.67)	(1.22)	(0.91)	(21.55)	(13.23)	(100.00)
	Group II	27.99	4.88	20.32	1.38	1.22	.90	18.30	9.90	84.89
		(32.97)	(5.75)	(23.94)	(1.63)	(1.44)	(1.06)	(21.56)	(11.66)	(100.00)
BOF	Group I	70.59	1.01	20.23	1.15	.31	-	31.33	22.57	147.09
		(47.99)	(0.69)	(13.75)	(0.78)	(0.21)		(21.30)	(15.34)	(100.00)
	Group II	72.64	1.1	20.38	1.22	.32	-	31.96	22.41	150.03
		(48.42)	(0.73)	(13.58)	(0.81)	(0.21)		(21.30)	(14.94)	(100.00)

Figures within parentheses indicate percentage of the total

(A=Ploughing, B=Manuring & fertilization, C=Transplanting, D=Sowing, E=Intercultural& irrigation, F=Earthing up, G=Harvesting, H=Threshing & transportation)

3.3 Family and Hired Labour Employment per Cropped Hectare

Impact of farm mechanization on hired and family labour is presented on Table 4.which showed the distribution of family and hired (both permanent and casual) labour for different categories of mechanized and Bullock Operated Farm. Table 4.revealed that out of total labour employment family labour employment was found to be 3.70,58.91,20.30,63.02 and 91.22 per cent in case of Tractor Ownership Farm, Tractor Hired Farm, Power Tiller Ownership Farm, Power Tiller Hired Farm and Bullock Operated Farm, respectively and hired labour employment was 96.30,41.09,79.70,36.98 and 8.78 per cent, respectively. Table showed that family labour employment was higher in case of Power Tiller Ownership Farm than Tractor Ownership Farm. The lower utilization of family labour in case of Tractor Ownership Farm might be due greater involvement

of occupation like service and business and also. Tractor Ownership Farm were financially sound having the capacity to pay for heir labour. Further, in case of Tractor Ownership Farm and Power Tiller Ownership Farm, the households utilized permanent hired labour however permanent labour involvement was nil in case of Tractor Hired Farm, Power Tiller Hired Farm and Bullock Operated Farm. This might be due to the reason of seasonal nature of agricultural crops along with farmers in these categories were relatively poor and not capable to invest wage by engaging labour permanently. Again in the case of Bullock Operated Farm, involvement of family labour was found to be highest i.e. 91.22 per cent indicated that Bullock Operated Farm had primary occupation in agriculture followed by wage earning.

Table 5. Showed labour utilization of different size group under various categories of mechanized and Bullock Operated Farm and revealed that family labour decreased with the increase in size group and hired labour increased with increase in the farm size. Thus, hired labour had positive relationship with farm size in each categories of mechanized and Bullock Operated Farmand family labour had negative relationship with farm size within each categories of mechanized and Bullock Operated Farm.

Table 4 .Distribution of family and hired labour per cropped hectare under various categories of Mechanized and Bullock Operated Farm (in man days)

Categories of Farms	Family Labour	Hired Labour			Total Human Labour
		Permanent	Casual	Total	
TOF	1.98	13.39	38.19	51.58	53.56
	(3.70)	(25.00)	(71.30)	(96.30)	(100.00)
THF	41.26	-	28.78	28.78	70.04
	(58.91)		(41.09)	(41.09)	(100.00)
PTOF	13.98	7.45	47.44	54.89	68.87
	(20.30)	(10.82)	(68.88)	(79.70)	(100.00)
PTHF	55.11	-	32.34	32.34	87.45
	(63.02)		(36.98)	(36.98)	(100.00)
BOF	134.91	-	12.99	12.99	147.90
	(91.22)		(8.78)	(8.78)	(100.00)

Figures within parentheses indicate percentage of the total

Table 5.Distribution of family and hired labour per cropped hectare under various categories of Mechanized and Bullock Operated Farm across different farm sizes (man days)

Categories of Farms	Farm Size	Family Labour	Hired Labour			Total Human Labour
			Permanent	Casual	Total	
TOF	Group III	1.98	13.39	38.19	51.58	53.56
		(3.70)	(25.00)	(71.30)	(96.30)	(100.00)
THF	Group I	43.56	-	28.38	28.38	71.94
		(60.55)		(39.45)	(39.45)	(100.00)
	Group II	38.95	-	28.56	28.56	67.51
		(57.70)		(42.30)	(42.30)	(100.00)
	Group III	27.55	8.88	26.36	35.24	62.79
		(43.88)	(14.14)	(41.98)	(56.12)	(100.00)
PTOF	Group II	14.67	6.75	47.34	54.09	68.76
		(21.34)	(9.82)	(68.85)	(78.66)	(100.00)
	Group III	13.45	7.98	47.54	55.52	68.97
		(19.50)	(11.57)	(68.93)	(80.50)	(100.00)
PTHF	Group I	57.9	-	31.3	31.30	89.20
		(64.91)		(35.09)	(35.09)	(100.00)
	Group II	51.03	-	33.86	33.86	84.89
		(60.11)		(39.89)	(39.89)	(100.00)
BOF	Group I	135.8	-	11.29	11.29	147.09
		(92.32)		(7.68)	(7.68)	(100.00)
	Group II	132.53	-	17.50	17.50	150.03
		(88.34)		(11.66)	(11.66)	(100.00)

Figures within parentheses indicate percentage of the total

20

4 Conclusion

Mechanization is need based process which provide sufficient time gap for self adjustment of various inputs which ultimately gives positive impact on agricultural production. Average labour employment per cropped hectare were estimated at 53.36, 70.04, 68.87, 87.45 and 147.9 man days for Tractor Ownership Farm, Tractor Hired Farm, Power Tiller Ownership Farm, Power Tiller Hired Farm and Bullock Operated Farm, respectively. It had been observed that human labour employment per cropped hectare in the study area was lower in case of mechanized farm than bullock operated farm. Labour displacement was highest in case Tractor Ownership Farm where employment of labour was 36.08 per cent followed by Power Tiller Ownership Farm which was 46.57 per cent. Labour employment per cropped hectare showed a declining trend with increase in farm group size under different categories of mechanized and bullock operated farm.

Again, human labour employment was less in case of mechanized farm than bullock operated farm such as ploughing, harvesting threshing and transportation and on the other hand, labour employment was found to be more in all mechanized farm than bullock operated farm for operation such as manuring, fertilization, intercultural operation and irrigation. labour employment and farm size had inverse relationship within different categories of mechanized and bullock operated farm and out of total labour employment family labour employment was found to be 3.70, 58.91, 20.30, 63.02 and 91.22 per cent in case of Tractor Ownership Farm, Tractor Hired Farm, Power Tiller Ownership Farm, Power Tiller Hired Farm and Bullock Operated Farm, respectively.

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