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Extent of farm mechanization in selected agroclimatic zones of Assam

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Abstract

The present study on 'Extent of farm mechanization in selected agroclimatic zones of Assam' was conducted in five agroclimatic zones of Assam. A sample of 600 farmers was selected randomly from five agroclimatic zones each comprising of 120 farmers. Data were collected by using structured interview schedule. The results of the study revealed that the overall mechanization of farm was 86 per cent in selected agroclimatic zones of Assam, while 14.00 per cent farms were operating with traditional practices of farm operations by using bullock and manual labour. The highest percentage of mechanization was observed in NBPZ (89.17 per cent) followed by CBVZ, UBVZ, BVZ and LBVZ accounting for 86.67 per cent, 85.83 per cent, 85.00 per cent and 83.33 per cent, respectively. Primary tillage/ ploughing, threshing and transportation were the major operations mechanised by 86.00 per cent,79.83 per cent and 53.39 per cent farmers respectively, while interculture operation, irrigation, harvesting and winnowing and bagging were mechanised by 10.83 per cent, 27.00 per cent, 7.12 per cent and 31.83 per cent farmers respectively. Among the different categories of farm mechanization, on an average, tractor hired farms (THF) occupied the highest percentage (50.97 per cent) followed by power tiller hired farms (PTHF), power tiller owned farms (PTOF) and tractor owned farms (TOF) with the percentage of 37.02, 7.95 and 4.07 respectively.

Keywords: Extent of mechanisation, farm mechanization, agroclimatic zones

Introduction

Agricultural mechanization helps to reduce the drudgery of the human beings and draught animals in one hand, and at the same time it contributes to enhance the cropping intensity, precision and timelines of farm operations, efficiency of utilisation of various crop inputs and reduction of the losses at different stages of crop production due to utilisation of various power sources and improved farm tools and equipment. The contribution of agricultural mechanization has been well recognized in enhancing the production together with irrigation, biological and chemical inputs of high yielding seed varieties, fertilizers, pesticides and mechanical energy. The necessity for farm mechanisation mainly arises due to increasing wage rate of both human and bullock labour, shortage of human labour during the peak crop season for carrying out the operations. Roy and Bezbaruah (2002) [4] reported that the mechanisation of farm is also inductive to the diversification of the cropping pattern, as it enables farmer to raise a second crop. The increasing trend in sale of tractors and power tillers over the years implied a growing acceptance of agricultural machines and equipments by the domestic farmers leading to a considerable progress towards mechanisation in land preparation, irrigation, harvesting threshing and transportation operations. Mechanization of small holding would play an important role in increasing rice production (Das, 2003) [2]. Farm mechanisation has very wide and far reaching effects upon the rural and political economy of the country as it led to enhancement of production and productivity of crops in India. Thus, agricultural mechanisation is not merely a proposition of agricultural engineering, but perhaps mainly a problem in agricultural economics (Bhattacharya, 1965) [1]. Farmers has been able to receive several economic and social benefits through farm mechanisation by saving inputs like seeds and fertilizers up to 15-20% and human labour requirement and operational time by 20-30%, while it increases cropping intensity by 5-20% and productivity by 10-15% (Tiwari *et al*, 2019) [5]. Nayak *et al.* (2011) [3] observed from study that there is great scope of tractor and stationary machineries for farm practices on the hire basis.

In Assam, there has been substantial use of different kinds of machineries in agriculture sector. However, very few study on farm mechanisation aspect at micro level or individual farmer level has been conducted encompassing all the agroclimatic zones of Assam. Moreover, no in depth study had been carried out on farm mechanisation on the aspects of extent of adoption of farm mechanisation. Therefore the present study was under taken on farm mechanisation with the specific objectives to examine the extent of farm mechanisation in Assam.

Materials and Methods

The study was conducted in Assam covering five Agro-climatic zones *viz*. Upper Brahmaputra Valley Zone (UBVZ), North Bank Plain Zone (NBPZ), Central Brahmaputra Valley Zone(CBVZ),Lower Brahmaputra Valley Zone(LBVZ) and Barak Valley Zone (BVZ) adopting multistage stratified random sampling design which encompassed district at the first stage, ADO circle at the second stage, village at the third stage and farmers as the final stage sampling unit.

From each of five selected agro-climatic zones of Assam, one district was selected randomly. In the second stage of sampling, two Agricultural Development Officer circles (ADO circle) were selected from each selected district covering all total 10 ADO circles from the five agro-climatic zones of the state. In the third stage of sampling, list of villages of the selected ADO circle were prepared and from those lists, 5 villages were selected for each ADO circle randomly. Thus, a total of 10 villages were selected randomly for each zone for drawing the final sample unit for the study.

The sample households 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) and Non –mechanised/ Bullock Operated Farm (BOF) on the basis of machine power and bullock power use in farm operation.

In the Final stage, 12 farmers from each of the five villages at the ratio of 4:3:2:1:: Marginal: small: Medium: Large were selected randomly. Thus, 60 farmers from each ADO circle (12 x 5) and 120 farmers from each district (12 x 5 x2)representing each of five agro-climatic zones of the state were selected finally for the study to make thetotal sample of 600 farm households for the state as a whole.

The relevant primary data were collected from 600 sample farms by personal interview method with the help of specially designed and pretested schedules for substantiating various objectives of the study. All the data collected from sample farms is pertained to the year 2019-20. Descriptive statistics like simple averages, percentages, and averages were estimated to draw the inferences ofthe results in the present study.

Table 1: Sampling design of various categories of farm in different Agroclimatic Zones of Assam

Categories of farm / Agroclimatic zones	Tractor Ownership Farm (TOF)	Tractor Hired Farm (THF)	Power Tiller Ownership Farm (PTOF)	Power Tiller Hired Farm (PTHF)	Non-mechanised Farm (BOF)	Total
UBVZ	3	54	6	40	17	120
NBPZ	5	54	7	41	13	120
CBVZ	5	55	9	35	16	120
LBVZ	5	49	8	38	20	120
BVZ	3	51	11	37	18	120
All zones	21	263	41	191	84	600

Results and Discussion

Extent of farm mechanization in selected agroclimatic zones of Assam

The extent of farm mechanization according to categories of mechanization in different agroclimatic zones of Assam is presented and discussed through the Table 2. The table reveals that the on an average 86 per cent farm mechanised various operations in selected agroclimatic zones of Assam. The highest percentage of farms mechanizing various operations was observed in NBPZ (89.17 per cent) followed by CBVZ, UBVZ, BVZ and LBVZ accounting for 86.67 per cent, 85.83 per cent, 85.00 per cent and 83.33 per cent, respectively. The results indicate that only 14.00 per cent farms were operating with traditional practices of farm operations by using bullock and manual labour. The adoption of higher level of farm mechanization in different farm operations across the different agroclimatic zones may be due to implementation of various types of govt. subsidized schemes on farm machinery in recent years in Assam.

Among the total mechanized farm and across the different categories of farm mechanization, on an average, tractor hired farms (THF) occupied the highest percentage (50.97 per cent) followed by power tiller hired farms (PTHF), power tiller owned farms (PTOF) and tractor owned farms (TOF) with the percentage of 37.02, 7.95 and 4.07 respectively. More or less similar trend was observed for different selected agroclimatic zones. This might be due to the fact that the tractor owned farms and power tiller own farms were comprised of large and medium farmers respectively, where number is relatively very small in comparison to small and marginal farmers. In contrary, the tractor hired farms (THF) and power tiller hired farms (PTHF) were constituted with mainly small and marginal farmers which really dominate the agriculture sector as a whole.

Among the various agroclimatic zones, the relative share of TOF total mechanized farm was found to be highest in LBVZ followed by CBVZ, NBVZ, BVZ and UBVZ with 5.00 per cent, 4.81 per cent, 4.67 per cent, 2.94 per cent and 2.91 per cent, respectively. Higher percentage of tractor (owned) indicates agricultural operations mainly ploughing; harvesting, transplanting and threshing can be done in quickly and timely. This timeliness of operations helps the farmers to accommodate more crops in cropping system leading to more cropping intensity. This is the reason for which cropping intensity is comparatively higher in CBVZ and LBVZ as compared to other selected zones.

Regarding PTOF, BVZ occupied the highest position (10.78 per cent) followed by CBVZ (8.65 per cent) and LBVZ (8.00 per cent), while UBVZ occupied the lowest position (5.83 per cent). It is also observed that on an average 50.97 per cent

farmers used tractor on hiring. The relative share households using tractor on hiring basis was found to be highest in LBVZ (55.00 per cent) and lowest in BVZ (36.27 per cent). In contrary, power tiller hiring farmers were observed to be highest (38.83 per cent) in UBVZ and lowest in CBVZ (33.65 per cent). Further, amongst the various selected agro-climatic zones, aggregate share of tractor owned farms (TOF) and power tiller owned farm (PTOF) was found to be comparatively lower in UBVZ and NBVZ as compared to LBVZ and CBVZ and BVZ. While opposite trend was seen in case of aggregate share of tractor hiring and power tiller hiring farms. This implies the fact that farmers in UBVZ and NBVZ which are less developed in agriculture compared to other selected zones, were compelled to go for custom hiring of tractor or power tiller due to insufficient number of tractor and power tiller resulting into lower cropping intensity.

Table 2: Extent of Farm Mechanization in the Selected Agro-climatic Zones of Assam (Numbers of farm)

Agro-climatic Zones	Categories of mechanisation				Total Mechanised Farm	Non –Mechanised Farm	Total
	TOF	PTOF	THF	PTHF			
UBVZ	3 (2.50) (2.91)	6 (5.00) (5.83)	54 (45.00) (52.43)	40 (33.33) (38.83)	103 (85.83) (100.00)	17 (14.17)	120 (100.00)
NBPZ	5 (4.17) (4.67)	7 (5.83) (6.54)	54 (45.00) (50.47)	41 (34.17) (38.32)	107 (89.17) (100.00)	13 (10.83)	120 (100.00)
CBVZ	5 (4.17) (4.81)	9 (7.50) (8.65)	55 (45.00) (51.92)	35 (29.17) (33.65)	104 (86.67) (100.00)	16 (13.33)	120 (100.00)
LBVZ	5 (4.17) (5.00)	8 (6.67) (8.00)	49 (45.83) (55.00)	38 (31.67) (38.00)	100 (83.33) (100.00)	20 (16.67)	120 (100.00)
BVZ	3 (2.50) (2.94)	11 (9.17) (10.78)	51 (40.83) (48.04)	37 (30.83) (36.27)	102 (85.00) (100.00)	18 (15.00)	120 (100.00)
All zones	21 (3.50) (4.07).	41 (6.83) (7.95)	263 (43.83) (50.97)	191 (31.83) (37.02)	516 (86.00) (100.00)	84 (14.00)	600 (100.00)

Figures within parentheses indicate percentage to total household in respective zones.

Figures with bold and italics indicate percentage to total mechanized farm in respective zones.

Table 3: Extent of Mechanization in Different Agricultural Operations in Assam (No. of Farmers)

Sl. No.	Particulars of operations	Mechanical	Mechanical +Manual /draught animal	Manual	Draught animal	Total	Total No. of Sample Farm
1	Preparatory tillage /ploughing	478 (79.67)	38 (6.33)	-	84 (14.00)	600 (100.00)	600 (100.00)
2	Transplanting/sowing	-	-	600 (100.00)	-	600 (100.00)	600 (100.00)
3	Manure and Fertilizer application	-	-	466 (77.67)	-	466.00 (77.67)	600 (100.00)
4	Weeding/interculture and earthing up	65 (10.83)	-	201 (33.50)	-	266 (44.00)	600 (100.00)
5	Plant protection	-	-	225 (37.50)	-	225 (37.50)	600 (100.00)
6	Irrigation	162 (27.00)	-	-	-	162 (27.00)	600 (100.00)
7	Transportation	320 (53.33)	-	280 (46.67)	-	600 (100.00)	600 (100.00)
8	Harvesting	43 (7.17)	-	557 (92.83)	-	600 (100)	600 (100.00)
9	Threshing	479 (79.83)	-	15 (2.50)	106 (17.67)	600 (100.00)	600 (100.00)
10	Winnowing and bagging	191 (31.83)	-	409 (68.17)	-	600 (100.00)	600 (100.00)

Figures within parenthesis indicate percentage to total sample household (row total)

Operation wise extent of farm mechanization in Assam according to Categories of Mechanised Farm

Table 3 reveals the operation wise extent of farm mechanization in Assam and depicts that the primary operations like ploughing was done mechanically by 79.67 per cent farmers, while combined mechanical + animal power was utilized by 6.33 per cent farmer for the same operation constituting altogether 86.00 per cent of mechanization in preparatory tillage or ploughing. In contrary drought animal power was utilized by only 14 per cent households as a whole.

Table 4: Extent of Mechanization in the Sample Farms of Assam according to Categories of Mechanised Farm (No. of Farm)

Sl. No.	Particulars of operations	Nature of operations	Mechanized Farm					Non mechanized Farm (N=84)	Total No. of Farms (N=600)
			TOF (N=21)	PTOF (N=41)	THF (N=263)	PTHF (N=191)	Total (N=516)		
1	Preparatory tillage /ploughing	Mechanical	21 (100.00)	41 (100.00)	249 (94.68)	167 (87.43)	478 (92.64)	-	478 (79.67)
		Mechanical+ Animal	-	-	14 (5.32)	24 (12.57)	38 (7.36)	-	38 (6.33)
		Draught animal	-	-	-	-		84 (100.00)	84 (14.00)
2	Transplanting/sowing	Mechanical	-	-	-	-	-	-	-
		Manual	21 (100.00)	41 (100.00)	263 (100.00)	190 (99.48)	516 (100.00)	84 (100.00)	600 (100.00)
3	Manure and Fertilizer application	Mechanical	-	-	-	-	-	-	-
		Manual	21 (100.00)	41 (100.00)	207 (78.71)	151 (79.06)	420 (81.40)	46 (54.76)	466 (77.67)
4	Weeding/interculture and earthing up	Mechanical	12 (57.14)	16 (39.02)	15 (5.70)	22 (11.52)	65 (12.60)		65 (10.83)
		Manual	8 (38.10)	23 (56.10)	84 (31.94)	70 (36.65)	185 (35.85)	16 (19.05)	201 (33.50)
5	Plant protection	Mechanical	-	-	-	-	-	-	-
		Manual	19 (90.48)	36 (87.80)	79 (30.04)	83 (43.46)	217 (42.05)	8 (9.52)	225 (37.50)
6	Irrigation	Mechanical	19 (90.48)	32 (78.05)	37 (14.07)	73 (38.22)	161 (31.20)	1 (1.19)	162 (27.00)
		Manual	-	-	-	-	-	-	-
7	Transportation	Mechanical	21 (100.00)	41 (100.00)	159 (60.46)	90 (47.12)	311 (60.27)	9 (10.71)	320 (53.33)
		Manual	-	-	104 (39.54)	101 (52.88)	205 (39.73)	75 (89.29)	280 (46.67)
8	Harvesting	Mechanical	9 (42.86)	19 (46.34)	9 (3.42)	6 (3.14)	43 (8.33)	-	43 (7.17)
		Manual	12 (57.14)	22 (53.66)	254 (96.58)	184 (96.34)	473 (91.67)	84 (100.00)	557 (92.83)
9	Threshing	Mechanical	21 (100.00)	41 (100.00)	246 (93.54)	171 (89.53)	479 (92.83)	-	479 (79.83)
		Manual	-	-	7 (2.66)	8 (4.19)	15 (2.91)	-	15 (2.50)
		Drought animal	-	-	10 (3.80)	12 (6.28)	22 (4.26)	84 (100.00)	106 (17.67)
10	Winnowing and bagging	Mechanical	6 (28.57)	17 (41.46)	94 (35.74)	75 (39.27)	192 (37.21)	-	192 (32.00)
		Manual	15 (71.43)	24 (58.54)	169 (64.26)	116 (60.73)	324 (62.79)	84 (100.00)	408 (68.00)

Figures within parentheses indicate percentage to total household in each category of farm

Interculture operations like manure and fertilizer application and plant protection measures were done manually by all the household (100 per cent) while weeding and earthing up was done both mechanically (10.83 per cent) and manually (33.50 per cent) household, respectively. Mechanical weeding was carried out only in mechanized farm only. 27.00 per cent of sample households used mechanical means for irrigation while irrigation through manual means was totally absent. Irrigation was found to be adopted by 31.20 per cent and 1.19 per cent households in mechanised and non mechanized farms, respectively.

Transportation through mechanical means was carried out by 53.33 per cent households, while harvesting was done mechanically by 7.17 per cent household only indicating that manual labour (92.83%) is still playing a dominant role in harvesting of crops. Regarding threshing 79.83 per cent farmer used machinery (tractor, power tiller, and thresher) in threshing operation, while 17.67 per cent households utilized drought animals and only 2.50 farmers used manual labour for threshing. All the non mechanized farms were observed to be used animal power in threshing operation.

Winnowing and bagging operation of produces were found to be mechanized in 32.00 per cent farms indicating that still a majority farmers (68.00 per cent) in Assam use manual labour for winnowing and bagging that mechanical means were adopted by mechanized farms only for ploughing/preparatory tillage, weeding, irrigation, harvesting threshing and winnowing and bagging operations while the non mechanized farms (Bullock operated farms) utilized bullock and manual labour in operation as needed.

Across the different categories of mechanised farms, it was observed that all the TOF and PTOF farms adopted 100 per cent mechanical ploughing followed by THF and PTHF accounting for 94.68 per cent and 87.43 per cent, respectively. This result was consistent with Nayak *et al.* (2011) [3] in Durg district of Chhattisgarh. Sowing and transplanting of different crops was done manually by 100 per cent farmers in all categories of mechanized and non mechanised farm (Table 4). Besides preparatory tillage/ ploughing operations, 100 percent households under TOF and PTOF categories utilized

mechanical power in the operations like transportation and threshing. On the other hand, weeding/interculture, irrigation, transportation and harvesting showed a varied trend in uitilisation of mechanical power.

Conclusion

The findings of the study revealed that the overall farm mechanization in selected agroclimatic zones of Assam was 86 per cent. Amongst the different agroclimatic zones, highest percentage of mechanization was observed in NBPZ (89.17 per cent). Primary tillage/ ploughing, threshing and transportation were the major operations mechanised by 86.00 per cent,79.83 per cent and 53.39 per cent farmers respectively, while interculture operation, irrigation, harvesting and winnowing and bagging were mechanised by 10.83 per cent, 27.00 per cent, 7.12 per cent and 31.83 per cent farmers respectively. Among the different categories of farm, tractor hired farms (THF) were found to be comparatively more mechanised as compared other categories of mechanised farms.

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