

CHAPTER - VI

**FACTORS AFFECTING AGRICULTURAL
MECHANISATION IN THE SELECTED DISTRICTS OF
WEST BENGAL**

I. INTRODUCTION

Mechanized agriculture is the process of using agricultural machinery to mechanize the work of agriculture. With the help of the machineries farmers are produced quality crops and get higher productivity. At the same time labour crisis is one the major factor which have been made farm sector costlier. According to Hanumantha Rao, 1972 “ farmers, whether in the developed or developing countries, mechanize farm operations when the biological source of energy, e.g. human and animal labour become more costly than the mechanical sources. There is a secular tendency everywhere for the biological sources to become costlier than the mechanical sources”. It is a big responsibility of farm sector to provide food supply for huge population. But the available lands for agriculture is going down rapidly due to industrialization, urbanization, land erosion, growth of population etc. That is why farmers have to grow required foods on this available arable land and for that they have to take up alternative farming system which is known as mechanized farming system. Current mechanized agriculture includes the use of tractors, combine harvester, threshers, power tillers, rotavators, sprayers, modern irrigations, high-yielding seeds, fertilizers, pesticides etc. So agriculture depends on these factors to get productive and effective farming. Ghosh in his study has observed that factors such as irrigation, access to institutional credits, size of land holding etc. found to have positive significant bearing on level of farm mechanization (B.K Ghosh, 2010).

Agriculture is leading source of income of 72 percent (Government of West Bengal, 2012) population living in rural areas of West Bengal. Total area cultivated in the state is 4991 thousand hectare, i.e. 57 per cent land out of 8684 thousand hectare land available in West Bengal. Farmers are cultivating different types of crops on this available sown area. But the most of the farmers are very poor. More or less 90 per cent farmers are belongs to small and

marginal landholders. They are not able to use sufficient fertilizer, pesticides, machineries, high yielding seeds etc. to get higher productivity.

Machineries used in farm sector made the possibility of multi-cropping and timely operation. Farmers are using variety of machineries for different crops. Agricultural mechanization is determined by the number of factors which are inter-related in mechanization such as size of land holding, level of education, availability of credit etc. Farmers who have large land holdings they are using big machineries and also possess some common machineries like power tiller, thresher, pump set, tractor, harvester etc. They are well aware about the benefits of improved machineries and purchase these machineries by taking loan from banks issuing the Kisan Credit Card (KCC). Although all farmers are habituated to use modern machineries on their small land holding, majority of them are using old wooden made farming equipments still due to lack of availability of credit and knowledge.

In this chapter we shall try to examine that level of land holding, access of institutional credits and level of education of farmers determine agricultural mechanization. First of all we shall use ANOVA test to test our following Null Hypothesis (H₀) given below:

1. Level of landholding does not determine agricultural mechanization (H₀) and alternative hypothesis is landholding determine agricultural mechanization (H₁).
2. Agricultural mechanization is not affected by access of farm credits (H₀) and alternative hypothesis is agricultural mechanization is affected by farm credit (H₁)
3. There is no impact of farmers education on agricultural mechanization (H₀) and alternative hypothesis is farmers education affects agricultural mechanization (H₁)

Secondly, we shall present Tables and diagrams to show the nature of relationship whether the relation is positive or negative. We are showing the results of ANOVA test to show the dependency of dependent variable which is level of farm mechanization on number of independent variables such as level of landholding, access of farm credits and level of education. In our Null Hypothesis (H₀) we have considered that agricultural mechanization does not depend on above noted independent variables. It can be proved that across the mean of different groups of independent variables such as different landholding, different level of education and access of credits are equal. That means there have not any variability

of mean within different groups. It will be proved if the Table value is greater than calculated value. On the other hand, if Table value of different level of significance is less than calculated value the Null Hypothesis (H₀) will be rejected.

II. LAND HOLDING AND FARM MECHANISATION

It is possible that there is relationship between land holding and agricultural mechanization. Since, land holding is going down due to over population, urbanization, industrialization etc. rural peoples are searching alternative jobs for their livelihood. They are migrating from farm sector to non -farm sector due to seasonal nature of work in farm sector. On the other hand, different types of farm machineries innovated by agro-research and development requires big land for their effective use. In many filed of farming we found that combine harvesters are not used for small landholding. In addition to that small farming increases the cost of cultivation. Let test our first hypothesis and see whether it is accepted or rejected. We are looking at the relation of landholding and farm mechanization for both the districts.

In our field survey study we found eight types of machineries are used by the farmers in both the districts. These machineries are tractor, power tiller, rotavator, thresher, irrigational machineries such as pump set, combine harvester, sprayer, and leveler. Use of these machineries is dependent variables in our study. It depends on level of land holdings which classified in to four categories. These are (i) marginal landholding having less than 8 bigha land (< 1 hectare), (ii) small landholding having 8 bigha to less than 15 bigha land (1 to < 2 hectare), (iii) semi- medium landholding having 15 bigha to less than 30 bigha land (2 to <4 hectare) and (iv) medium landholding having 30 bigha and above landholding(4 to above hectare). The Tables related to the data are presented below.

Table 6.1: Use of Machineries on the basis of Landholding in Dakshin Dinajpur District

Level of Mechanization	Landholding of Dakshin Dinajpur district			
	< 8 bigha land	8 bigha and <15 bigha	15 bigha and < 30 bigha	30 bigha and above
Tractor	64	10	4	1
Rotavator	31	6	1	1
Power tiller	45	10	2	1
Thresher	33	6	4	1
Pump set	100	14	5	1
Sprayer	98	14	5	1
Combine harvester	9	0	3	0
Leveler	31	6	1	1

Source: Field survey

In the above Table we can see that the number of households using different types of farm machineries according to their landholding. It is visible that as the landholding increases the users of farm machineries has been going down because number of households also decreasing with higher level of landholding found in our study. As we know marginal farmers are not able to use the big machineries they very much interested to use small but useful farm machineries such as pump-set, sprayer etc. Since tractor is very much useful in farm sector almost all types farmers are using this particular farm machinery with large extent for their farm work. In the following Table we have seen the relation use of farm machinery on the basis of different level of landholding with help of ANOVA test.

Table 6.2: ANOVA Test for the Relation of Landholding and Agricultural Mechanization in Dakshin Dinajpur District

ANOVA

machine

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13647.594	3	4549.198	16.171	.000
Within Groups	7877.125	28	281.326		
Total	21524.719	31			

The above ANOVA Table shows the relation between agricultural mechanization and different level of landholding of Dakshin Dinajpur district. We can see at 0.05 per cent level of significance the Table value is 3.34 and our calculated value is 16.171. It is clear that Table value is smaller than calculated value i.e. our Null Hypothesis (H₀) is rejected and Alternative Hypothesis (H₁) is accepted. Similarly, at 0.01 per cent level of significance Table value is 5.45 and calculated value is 16.171. Here also our Null Hypothesis (H₀) is rejected and Alternative Hypothesis (H₁) is accepted. In both level of significance we found that table value is less than calculated value i.e. Null Hypothesis is rejected and it shows across the landholding mechanization differs.

Table 6.3: Use of Machineries on the Basis of Landholding in Bardhaman District

Machineries	Landholding of Bardhaman district			
	< 8 bigha land	8 bigha and <15 bigha	15 bigha and < 30 bigha	30 bigha and above
Tractor	14	12	11	3
Rotavator	28	34	37	6
Power tiller	15	18	15	5
Thresher	34	38	36	7
Pump set	36	38	39	7
Sprayer	34	38	39	7
Combine harvester	2	3	10	4
Leveler	32	36	38	6

Source: Field survey

In this Table we have shown data related to machinery used according to landholding in Bardhaman district. It is noticeable that farmers of this district heavily depend on rotavator for tilling their land. It is worth mentioning that landholding level is quite good in Bardhaman compared to Dakshin Dinajpur district. The following Table the shows the ANOVA test for the above data.

Table 6.4: ANOVA Test for the Relation of Landholding and Agricultural Mechanization in Bardhaman District

ANOVA

machine

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2673.500	3	891.167	6.736	.001
Within Groups	3704.500	28	132.304		
Total	6378.000	31			

In the above ANOVA Table we are explaining the relation between landholding and agricultural mechanization in Bardhaman district. We can see that calculated value which is 6.736 percent is greater than the Table values at both 0.05 per cent and 0.01 per cent level of significance which are 3.34 and 5.45 respectively. It implies that across the land holding level of agricultural mechanization is different. As a result we can say that Null Hypothesis is rejected and Alternative Hypothesis is accepted i.e. across the landholding level of farm mechanization changes.

Again we have assumed that agricultural mechanization is positively related with the landholding. Here we have considered owner of farm machineries to measure the intensity of agricultural mechanization. Operational land holding having below one hectare is 88.8 per cent in West Bengal and 69.8 per cent is for all India. Similarly, 8.9 per cent for 1 to 2 hectare and 2.10 for 2 to 4 hectare land holding for West Bengal (Government of West Bengal, 2012). Since land are scattered due to the fragmented families farmers cannot use some machineries such as tractor for tilling, harvester for harvesting etc. So they are using only small but efficient equipments like small pump set, sprayer, thresher, power tiller

etc.on rent. Although some small farmers are able to purchase these small equipments but majority of them use these on hiring system. Only farmers who have sufficient land holding, they are owner of these machineries. Price of such machineries is not affordable to small and marginal farmers. Besides they are not agreeing to purchase these machineries for their small land. They are using these machineries on hiring system or they are using bullock operated traditional equipments.

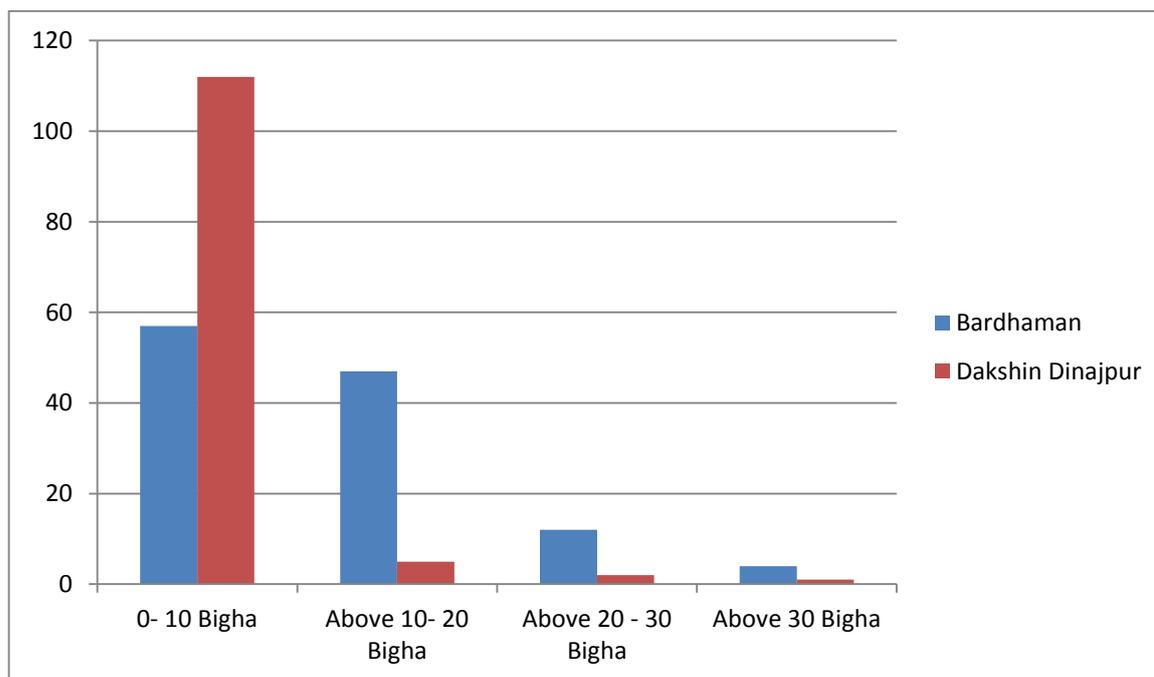
Table 6.5: Land Holding of Bardhaman and Dakshin Dinajpur Districts in Bigha

Level of Landholding	Bardhaman		Dakshin Dinajpur	
	No.	Percentage	No.	Percentage
0 to 10	57	47.5	112	93.33
Above 10 to 20	47	39.17	5	4.17
Above 20 to 30	12	10	2	1.67
Above 30	4	3.33	1	0.83
Total	120	100	120	100

Source: Field survey

In the above Table we are showing land holding of the two selected districts. We have classified landholding into four categories viz. 0-10, above 10-20, above 20-30 and above 30 in bigha. It is noticeable that 93.33 per cent household of Dakshin Dinajpur district is under 0-10 bigha landholding whereas it is 47.5 per cent in Bardhaman. In the second category landholding the percentage of household is 39.17 in Bardhaman and only 4.17 per cent in Dakshin Dinajpur Gradually number of household is decreasing as level of landholding increasing in both the districts but picture of landholding is quite poor in Dakshin Dinajpur compared to Bardhaman district.

Figure: 6.1: Land Holding of Bardhaman and Dakshin Dinajpur Districts in Bigha



The number of households according to level of landholding will be more cleared if we see the above diagram. In the above diagram we have measured number of household by red bar for Dakshin Dinajpur and blue bar for Bardhaman district. It is cleared that red bar is quite high compared to blue bar when landholding is 0-10 bigha ie. Most of the households of Dakshing Dinajpur belongs to marginal categories compared to Bardhaman district. Similarly we can see that households having landholding above 10-20 bigha is higher in Bardhaman and it is negligible in Dakshin Dinajpur. Households having above 20 bigha land are quite low for both the districts.

In modern agriculture different types of improved machineries are used to get higher productivity. These machineries are tractor, power tiller, rotavator, combine harvester, thresher, driller, pump set, power sprayer, zero tilling machineries, etc. But few selected machineries are used in West Bengal such as tractor, power tiller, rotavator, pump set, thresher, harvester, sprayer etc. The number of machineries used in the selected two districts has given below:

Table 6.6: Farm Machineries available in two Selected Distrcits

Machineries						
Distrcits	Tractor	Power tiller	Pumpset	Thresher	Sprayer	Submersible
Bardhaman	8	5	81	84	95	7
Dakshin Dinajpur	1	2	26	25	84	1
Total	9	7	107	109	179	8

Source: Field survey

The above Table shows over all availability of some common farm machineries such as tractor, power tiller, pump set, thresher, sprayer and submersible. It is visible that there are 8 tractors in Bardhaman district and the number of tractor available in Dakshin Dinajpur is only one out of 120 household surveyed in each block. The ownership of other machineries are: power tiller- 5 in Bardhaman and 2 in Dakshin Dinajpur, pump set- 81 in Bardhaman and 26 in Dinajpur, thresher 84 in Bardhaman and 25 in Dinajpur, sprayer - 95 in Bardhaman and 84 in Dinajpur and submersible - 7 exist in Bardhaman and only one in Dinajpur. So it is clear that availability of machineries is higher in Bardhaman compared to Dakshin Dinajpur district because most of the farm households have economic landholding in Bardhaman and most of them purchased small farm machineries. But since farmers found in Dakshin Dinajpur is poor they are using such farm machineries on rental system.

To give clear idea about positive relation between landholding and agricultural mechanization we are showing data in two Tables related to size of landholding and ownership of farm machineries. In the first Table we are citing the population of farm machineries of Bardhaman district according to the size of landholding in bigha.

Table 6.7: Availability of Machineries on the basis of Landholding in Bigha in Bardhaman

Landholding	Tractor	Power tiller	Pump set	Thresher	Sprayer	Sub-mersible
0 to 10	0	0	21	27	35	1
Above 10 to 20	5	1	44	41	44	2
Above 20 to 30	2	4	12	12	12	4
Above 30	1	0	4	4	4	0
Total	8	5	81	84	95	7

Source: Field survey

*0-10 Bigha= 57, **Above 10-20 Bigha= 47, ***Above 20-30 Bigha=12, ****Above 30 Bigha=4.

In the above Table we have collected data on different types of farm machineries used in Bardhaman district according to different classes of land holding. It is noticeable that availability of pump set, thresher and sprayer has been increasing along with increasing size of land holding. More or less all farmers having land holding above 10 bigha land is the owner of these machineries in Bardhaman district. It is also noticeable that farmers having land above 15 bigha is the owner of heavy and expensive machineries like tractor, power tiller and submersible.

Figure 6.2: Availability of Machineries on the basis of Landholding in Bigha in Bardhaman

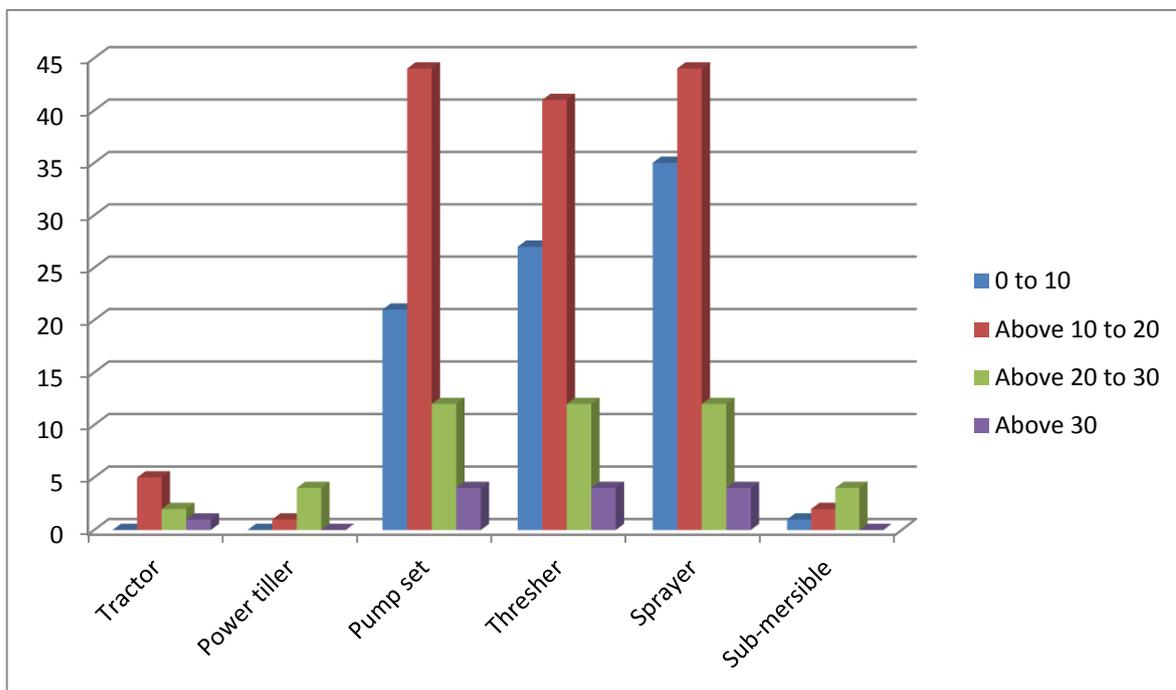


Table 6.8: Availability of Machineries on the basis of Landholding in Bigha in Dakshin Dinajpur

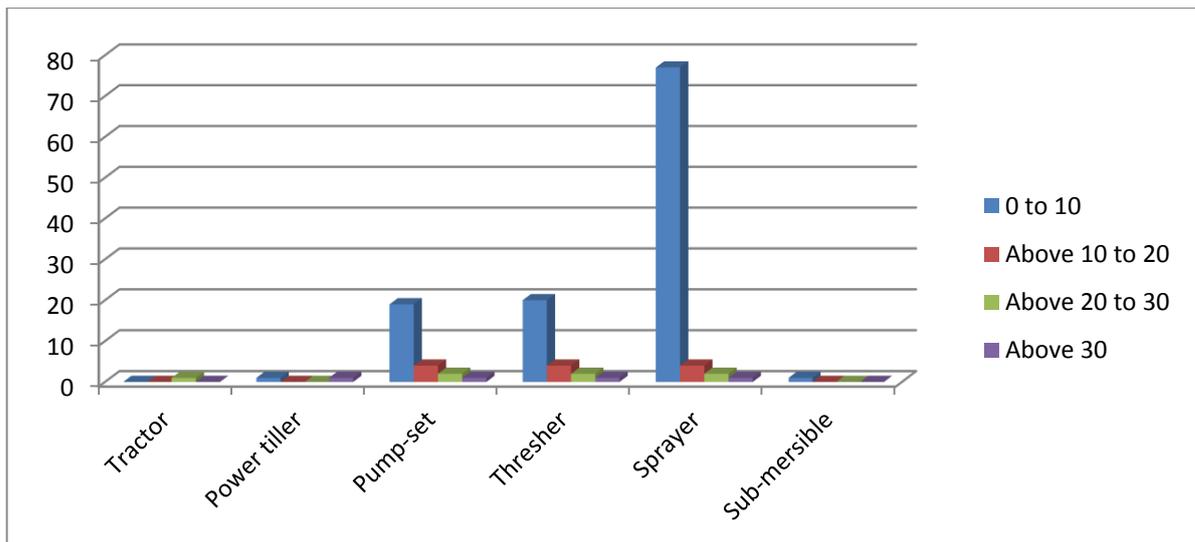
Landholding	Tractor	Power tiller	Pump-set	Thresher	Sprayer	Sub-mersible
0 to 10	0	1	19	20	77	1
Above 10 to 20	0	0	4	4	4	0
Above 20 to 30	1	0	2	2	2	0
Above 30	0	1	1	1	1	0
Total	1	2	26	27	84	1

Source: Field survey

*0-10 Bigha=112. **Above 10-20 Bigha=5, *** Above 20-30 Bigha=2, **** Above 30 Bigha= 1.

The population of farm machineries of Dakshin Dinajpur district has been presented in the above Table according to the size land holding in bigha. It was expected that owner of farm machineries is very less in this district since land holding is very small. On field survey it could be found that in Dakshin Dinajpur district the number of machineries used is very less. It is sprayer which has occupied the highest portion of farm machineries used in Dakshin Dinajpur district between landholding of 0 to 10 bigha. Since size of land holding is very small in this district the use of other farm machineries such as pump set, thresher, power tiller, tractor and submersible is very less compared to Bardhaman district. It is noticeable that owner of some machineries such as pump set, thresher and sprayer is visible in land holding between above 10 to 20 bigha. So it is cleared that since farm households of Dakshin Dinajpur district is quite poor they are not able to purchased farm machineries rather they are using the machineries on hiring system.

Figure 6.3: Availability of Machineries on the basis of Landholding in Bigha in Dakshin Dinajpur



In this section we want to show that population of farm machinery is positively related with land holding. It is fact that big farmers are using machineries with large extend since they are able to purchase them and side by side they can't depends on animal oriented farming machineries for the timely operation. But the farmers who are poor they only use some

cheap but effective machineries. So animal driven wooden equipments are main source of farming to them. But it is not true that they are not using modern machineries rather these machineries used by them on custom hiring system. But the matter of concern is that since their land holding too low they can't use big machineries such as tractor, power tiller, combine harvester etc.

As our requirements we found that total 8 tractor is exist in Bardhaman district and these tractors are purchased by the farmers whose land holding is 10 to 30 bigha. Similarly others machineries such as power tiller, thresher, harvester, pump set are available within that range of land holding in Bardhaman district. On the other hand owner of machineries is very less in Dakshin Dinajpur district because land holding is very low. We found that only one tractor is exist throughout the surveyed household and owner of this tractor belongs to land holding range 25 to 30 bigha. Similarly other machineries has purchased by the farmers whose land holding is between the ranges of 5 to 10 bighas land. Only cheap machineries which is sprayer price is Rs 700 to Rs 1500 is available in land holding 0 to 5 bigha. After concentrating on the above result we can conclude that agricultural mechanization is positively related with land holding.

In the following Table we have shown that extent of farm machinery users in number and percentage on the basis of level of land holding in case of Dakshin Dinajpur district. We can see that as landholding increasing percentage of machine users has been going up. It has found that except sprayer and pump-set for the other big machineries percentage of user has been increasing. Because comparatively large farmers are able to use such machineries for their cultivation. On the other hand, if we see the total number and percentage of farm machine users only sprayer and pump-set achieve in 100 per cent or near 100 per cent success. The main reason is that still farmer of this district are not able to purchase and use the farm machineries in complete farm operation.

Table 6.9: Use of Machineries on the basis of Landholding in Dakshin Dinajpur District

Level of Mechanization	< 8 bigha land		8 bigha and <15 bigha		15 bigha and < 30 bigha		30 bigha and above		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Tractor	64	64%	10	71.42%	4	80%	1	100%	79	65.83%
Rotavator	31	31%	6	42.85%	1	20%	1	100%	39	32.5%
Power tiller	45	45%	10	71.42%	2	40%	1	100%	58	48.33%
Thresher	33	33%	6	42.85%	4	80%	1	100%	46	38.33%
Pump set	100	100%	14	100%	5	100%	1	100%	120	100%
Sprayer	98	98%	14	100%	5	100%	1	100%	118	98.33%
Combine harvester	9	9%	0	0%	3	60%	0	0%	11	9.16%
Leveler	31	31%	6	42.85%	1	20%	1	100%	39	32.5%

Source: Field survey

*Total households having < 8 bigha land= 100,** Total households having 8 bigha and < 15 bigha= 14,*** Total households having 15 bigha and < 30 bigha= 5,**** Total households having 30 bigha and above= 1

Similarly, the Table 5.C shows use of farm machineries on the basis of landholding of Bardhaman district. The given data exhibit that landholding is quite good in Bardhaman compared to Dakshin Dinajpur District. Here we can see that farmers of this district have

Table 6.10: Use of Machineries on the Basis of Landholding in Bardhaman District

Level of Mechanization	< 8 bigha land		8 bigha and <15 bigha		15 bigha and < 30 bigha		30 bigha and above		Total	
	Nu mbe r	Percenta ge	Nu mbe r	Percent age	Nu mbe r	Percenta ge	Nu mbe r	Percenta ge	Nu mbe r	Percent age
Tractor	14	38.88%	12	31.57%	11	28.20%	3	42.85%	40	33.33%
Rotavator	28	77.77%	34	89.47%	37	94.87%	6	85.71%	105	87.5%
Power tiller	15	41.66%	18	47.36%	15	38.46%	5	71.42%	53	44.16%
Thresher	34	94.44%	38	100%	36	92.30%	7	100%	115	95.83%
Pump set	36	100%	38	100%	39	100%	7	100%	120	100%
Sprayer	34	94.44%	38	100%	39	100%	7	100%	118	98.33%
Combine harvester	2	5.55%	3	7.89%	10	25.64%	4	57.14%	19	15.83%
Leveler	32	88.88%	36	94.73%	38	94.43%	6	85.71%	112	93.33%

Source: Field survey

*Total households having < 8 bigha land= 36. ** Total households having 8 bigha and < 15 bigha= 38. *** Total households having 15 bigha and < 30 bigha= 39. **** Total households having 30 bigha and above= 7

been using big machineries such as rotavator, thresher, combine harvester etc. It is possible because of higher landholding of the farmers. On the other hand, they have also been using the other small machineries for their cultivation.

III. USE OF CREDIT AND EXTENT OF FARM MECHANISATION

A farm credit plays a vital role in agriculture sector. Farmers are using credits to purchase the farm machineries. Credits may come from two sources say institutional source and non-institutional source. A large part of population of India is very poor and depends on the agricultural sector. These poor farmers are not able to produce enough crops for their survival. On the other hand, investment in farm sector is very important to get higher productivity. To get higher productivity farmers need to apply required fertilizers, irrigation,

high yielding seeds and improved machineries for timely operation etc. But poor farmers cannot use these ingredients because of poor income. Among all the above ingredients of farming, farm machineries play a vital role in effective farming. Without machineries timely operation of farming is not possible. These machineries give higher productivity and mitigate the cost of cultivation. But such machineries are not affordable to the poor farmers. Only few large farmers can fulfill these requirements and get higher level of production. Marginal and small farmers not able to purchase common cheap farm machineries e.g. pump set, small thresher, sprayer etc. because of their low level of income. So they use these machineries on hiring system. But if institutional farm credit is available to them they can purchase all types machines as required. So we can say that availability of credits has impact on agricultural mechanization. This is our second hypothesis and we shall test this hypothesis bellow.

Here our Null Hypothesis (H₀) that is agricultural mechanization is not affected by access of farm credits. To test it we have classified farmers into three categories who are using farm credits. These are farmers who are using institutional credit, farmers who are using non-institutional credits and farmers who have not used any types of credit for their cultivation. On the basis of these three categories of farmers we shall explain the level of mechanization. The following Table shows the statistics of farm credits and farm mechanization.

Table 6.11: Use of Machineries based on Access of Farm Credits in Dakshin Dinajpur District

Machineries	Access of credits from different sources		
	Farmers not using any type of credit	Farmers using non-institutional credits	Farmers using institutional credits
Tractor	64	7	8
Rotavator	28	5	6
Power tiller	46	7	5
Thresher	36	4	6
Pump set	98	10	12
Sprayer	96	10	12
Combine harvester	3	2	6
Leveler	29	4	6

Source: Field survey

In the above Table we are have shown the relation between use of farm machineries and access of credits to farmers in Dakshin Dinajpur district. It is worth mentioning that the number of user of institutional credits is very small in this district. So peoples are cultivating crops by investing capital from own savings or they are taking credits from non-institutional sources.

Table 6.12:ANOVA Test for the Relation of Access to Credits and Mechanization in Dinajpur

ANOVA

machine

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9870.333	2	4935.167	12.955	.000
Within Groups	7999.625	21	380.935		
Total	17869.958	23			

The above Table shows the ANOVA test related to access to farm credits and level of agricultural mechanization. We can see the calculated value is 12.955 whereas table value for both at 0.05 per cent level of significance which is 3.47 and 0.01 per cent level of significance which is 5.78. It is clear that calculated value is much higher than table value for both levels of significance. As we know when calculated value is greater than table value our Null Hypothesis will be rejected. As a result our Null Hypothesis (H₀) has rejected i.e. access of credits determines level of farm mechanization.

Table 6.13: Use of Machineries based on Access of Farm Credits in Bardhaman District

Machineries	Access of credits from different sources		
	Farmers not using any type of credits	Farmers using non-institutional credits	Farmers using institutional credits
Tractor	19	0	21
Rotavator	46	4	55
Power tiller	26	1	26
Thresher	53	4	58
Pump set	56	4	60
Sprayer	56	4	58
Combine harvester	6	1	12
Leveler	54	4	54

Source: Field survey

In the above Table we have shown the relationship between farm credits and farm mechanization of Bardhaman district. It is very important to say that number of households who are taking institutional credits is quite higher than the farmers who are taking loan from non-institutional sources. The above data also shows that most of the farmers are not dependent on any type of credits but they are using farm machineries on hiring system. The relation between access to credits and extent of mechanization has shown given bellow.

Table 6.14: ANOVA Test for the Relation of Access of Credits and Mechanization in Bardhaman

ANOVA

machine

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7954.333	2	3977.167	15.287	.000
Within Groups	5463.500	21	260.167		
Total	13417.833	23			

The above ANOVA Table shows the relation between access of credit and level of mechanization. In our above test we can see calculated value, 15.29 is higher than table

value for both 0.05 per cent and 0.01 per cent level of significance which are 3.47 and 5.78 respectively. So we can say that agricultural mechanization differs across access to credits in Bardhaman district.

There are three main factors that contribute agricultural growth are (i) use of agricultural input, (ii) technological change and (iii) technical efficiency. But to utilize all these factors properly farmers are to depend on farm credit. Because marginal farmers are unable to purchase such factors as their income is very low. As a result they are needy of farm credit to different source of financial institutions. An important aspect that has emerged in last three decades is that the credit is not only obtained by the small and marginal farmers for survival but also by large farmers for enhancing their income. That is why agricultural credit has been occupying an important role for development of agriculture. The credit system in India consists of formal and informal sources of credit supply. The formal source is commercial banks, regional rural banks, cooperative banks, private banks etc. whereas the informal sources are relatives, village money lender, trader, commission agents etc.

There is positive relation between availability of farm credit and use of farm machineries. For purchasing some small farm equipments like sprayer, small thresher, khurpi there is no need of farm credit. Any small farmer can purchase these small equipment by of their small income. But to purchase some common and necessary farm equipments like pump set, submersible, tractor, power tiller, big thresher, harvester, digger etc. farm credit is highly required factor to the farmers. It was found that farmers who are comparatively rich having 10 to 25 bigha land holding are the owner of such farm machineries and they have purchased all these machineries on credits. So different sources of credit is playing very important role in farm sector. The sources of farm credit in two selected districts of West Bengal have been shown in the following Table.

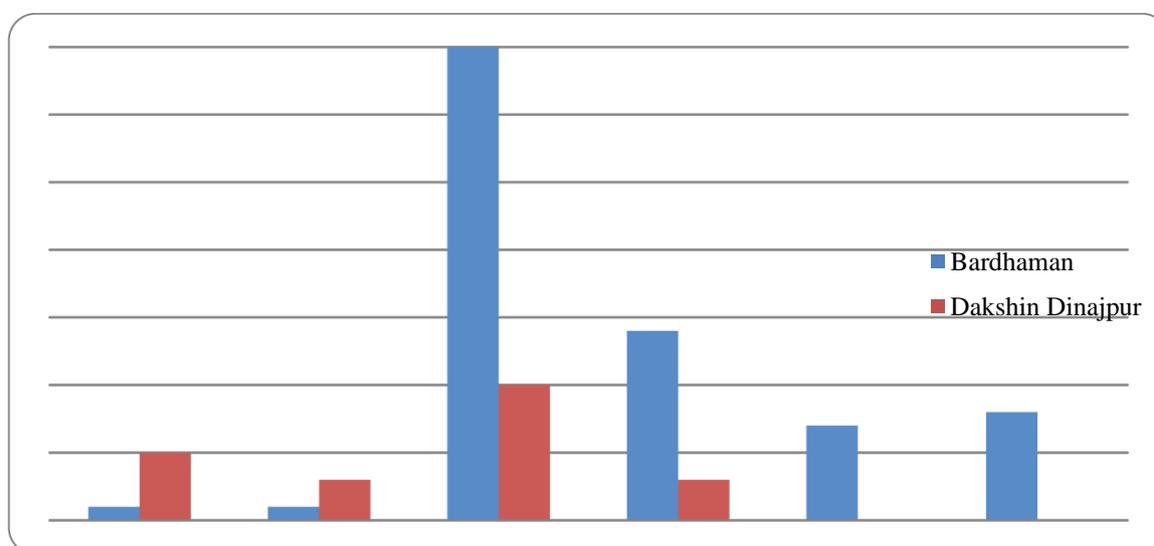
Table 6.15: Numbers of Households Taking Credits from Institutional and Non-institutional Sources

District/ blocks	Availability of credits in Both Districts						
	Village Trader	Money Lender	Cooperative Bank	SBI	Bank of India	Bank of Boroda	Total
Bardhaman	1	3	32	14	6	8	64
Dakshin Dinajpur	7	3	9	3	0	0	22
Total	8	6	41	17	6	8	86

Source: Field survey

It can be seen from the above Table that total borrowers are 66 in Bardhaman district. Farmers have taken loan from different sources and major part of loan has been taken from Cooperative Banks and then from SBI and Bank of Baroda. Only a single borrower is there who has taken loan from village money lender and from village trader. But the institutional creditor in Dakshin Dinajpur is very less. Only 21 households have received credit from this source on which 10 from Cooperative Banks and 3 from SBI. Existence of village trader and money lender is still there in this district. Total 5 village traders and 3 village money lenders have been found in this district.

Figure: 6.4: Sources of Borrowing Credits in the Two Districts



To give clear picture of different sources of credits we have presented the data in the above bar diagram. We can see that blue bar which is denoting Cooperative Banks in Bardhaman district has occupied highest position among other institutional sources of credit. After that SBI stands on the second position and then Bank of India followed by Bank of Boroda. But in Dakshin Dinajpur only Cooperative Bank has provided credit to a good number of farmers.

Now we shall try to give the explanation of positive relation between farm credits and agricultural mechanization. In our study we have found that farmers are using little common equipments on their arable land such as tractor, power tiller, rotavator, thresher, harvester, pump set, sprayer, submersible and leveler. Farmers who are marginal can afford only hand sprayer and if possible they purchase a thresher because price of these machineries is not very high. But to purchase tractor, power tiller, pump set and submersible credits is indispensable factor to the farmers. Although few farmers can purchase small pump set price of which ranges Rs.7000 to Rs.12000, educated farmers purchase these machineries on institutional credits where they get huge subsidy. So we can say that farm credits expand farm mechanization.

In the following Table we are giving statistics of farm credits taken from different sources to purchase farm machineries in Dakshin Dinajpur district. We can see farmers who are taking institutional credits they are purchasing heavy machineries such as tractor, power tiller, pump-set and submersible pumps. In this Table we can see 1 tractor, 2 power tillers and 1 submersible price of which is very high has been purchased by taking credits from institutional sources. Some of them also purchase machineries taking credits from non-institutional sources. But few machineries such as thresher, sprayer price of which not much higher purchased from own source of incomes.

Table 6.16: Credits Used to Purchase Different Farm Machineries in Dakshin Dinajpur District

Machineries	Different sources of credits			
	Own source	Non-institutional	Institutional	Total Machineries
Tractor	0	0	1	1
Power tiller	0	0	2	2
Thresher	18	1	6	25
Pump set	5	9	12	26
Sprayer	65	7	12	84
Submersible	0	0	1	1

Source: Field survey

The Table given below has shown access of credits and purchase of farm machineries of Bardhaman district. We can see total 8 tractors and 5 power tillers and 7 submersible which are considered as heavy machinery have been purchased at subsidized rate taking loan from banks. Similarly, total 81 pump sets are available in this district of which 47 have been purchased from institutional credits, 4 from non-institutional credits and 5 from own sources of income. On the other hand, total 84 threshers exist in this district out of which 49 have been purchased from institutional credits, 4 from non-institutional credits and 31 from own source. At the same time purchasing trends of sprayer is the same as pump set and thresher. So we can say that mechanization is increasing along with access to farm credits.

Table 6.17: Credits Used to Purchase Different Farm Machineries in Bardhaman District

Machineries	Different sources of credits			
	Own source	Non-institutional	Institutional	Total Machineries
Tractor	0	0	8	8
Power tiller	0	0	5	5
Thresher	31	4	49	84
Pump set	30	4	47	81
Sprayer	38	3	54	95
Submersible	0	0	7	7

Source: Field survey

Thus we can find that the number of borrowers is very large in Bardhaman district compared to Dakshin Dinajpur. In total 60 institutional borrowers was found in Bardhaman district which was only 12 in Dakshin Dinajpur. Similarly, we found a total of 280

machineries such as tractor, power tiller, thresher, harvester, pump set, sprayer, and submersible has found in Bardhaman. On the other hand, total number of such machineries is only 139 of which sprayer is generally purchased from own sources of incomes due to small price and it has alone occupied a major portion of such machineries. So we can conclude that farmers can extend the use of farm machineries by taking credits from institutional sources that means there is positive relation between institutional credit and use of farm machineries.

Table 6.18: Use of Machineries based on Access of Farm Credits in Dakshin Dinajpur District

Machineries	Access of credits from different sources							
	Farmers not using any type of credit		Farmers using non-institutional credits		Farmers using institutional credits		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Tractor	64	65.30%	7	70%	8	66.66%	79	65.83%
Rotavator	28	28.57%	5	50%	6	50%	39	32.5%
Power tiller	46	46.93%	7	70%	5	41.66%	58	48.33%
Thresher	36	36.73%	4	40%	6	50%	46	38.33%
Pump set	98	100%	10	100%	12	100%	120	100%
Sprayer	96	100%	10	100%	12	100%	118	98.33%
Combine harvester	3	3.06%	2	20%	6	50%	11	9.16%
Leveler	29	29.59%	4	40%	6	50%	39	32.5%

Source: Field survey

Notes: *Total farmers who did not obtain any type of credit= 98. ** Total farmers who have obtained non-institutional credits=10. *** Total farmers who have obtained institutional credits=12

In the above Table we have classified the farmers into three categories say, farmers using institutional credit, farmers are using non-institutional credit and farmers who are not using any types of farm credit. It has found that most of the farmers of this district are using farm

credit to use or purchase farm machineries for their cultivation. In this Table we can see that total 79 farmers are using tractor for their cultivation among which only 8 farmers are taking loan from institutional source, 7 farmers are taking loan from non-institutional source and 64 farmers are not using any types of credit from any source. In this way we can show statistics of other farmer who are using different farm machineries on the basis of credits receive from different sources and farmer who are not receive any type of farm credit. Similarly, we can classify the farmers under above mentioned three categories according use of farm machineries in percentage wise. For example we can see 65 per cent out of total 98 farmers who are not using any types of farm credit are using tractor for their cultivation. In this way, we show the percentage of farmers who are using different farm machineries taking credit from institutional and non-institutional sources. From this Table we can conclude that only small farm machineries such as pump-set and sprayer farmer are not depending on farm credits.

Table 6.19: Use of Machineries based on Access of Farm Credits in Bardhaman District

Machineries	Access of credits from different sources							
	Farmers not using any type of credits		Farmers using non-institutional credits		Farmers using institutional credits		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Tractor	19	33.92%	0	0%	21	35%	40	33.33%
Rotavator	46	82.14%	4	100%	55	91.66%	105	87.5%
Power tiller	26	46.42%	1	25%	26	43.33%	53	44.16%
Thresher	53	94.64%	4	100%	58	96.66%	115	95.83%
Pump set	56	100%	4	100%	60	100%	120	100%
Sprayer	56	100%	4	100%	58	96.66%	118	98.33%
Combine harvester	6	10.71%	1	25%	12	20%	19	15.83%
Leveler	54	96.42%	4	100%	54	90%	112	93.33%

Source: Field survey

Notes: (i) Total farmers who have not taken any types of credits= 56. (ii) Total farmers who have taken non-institutional credits=4. (iii) Total farmers who have taken institutional credits=60

In the above Table we have shown the extent of farmers who are using different farm machineries taking credits from different sources and farmers who are not taking any credits to use the machineries for their cultivation. The above data shows that most of the farmers of this district are using farm machineries taking credit from institutional sources. Farmers of this district have been using almost all types of farm machineries by using credits from institutional sources. Some of them also are taking credit from non-institutional sources to use such machineries.

IV. EDUCATION AND FARM MECHANISATION

Education is an indispensable factor of modern agricultural system. A minimum level of education is required to get benefit of modern agriculture. To boost up the farm sector government has been providing number of schemes to punches of farm machineries at subsidies rate. Similarly, government also has been providing agricultural credit at lower rate of interest, insurance schemes of crops and free advice on farming. An educated and sincere farmer can enjoy the facilities provided by the state as well as central government. Educated farmers cultivate scientifically with accurate farming ingredients. If their crops are attacked by insects they can take help of Agricultural Development Officers (ADO) at nearby agricultural offices. After detection of harmful insects they can use pesticides free of cost or by paying negligible price. But who are not aware about these facilities they can undertake following two measures. Firstly, they can buy these ingredients from market paying higher price. Secondly, if farmers who are not capable to purchase these expensive pesticides they leave the future of crops to God. We have found in our study that officials are ready to supply such kind of services but the number of recipients is very less because of lack of knowledge. So education is very important for the farmers.

On the other hand, farmers who are educated they are taking loan from banks through the Kisan Kredit Card (KCC). It is worth mentioning that bulks of farmers are afraid of institutional loan because borrowers have to keep their papers of land to banks as mortgage. On the other hand, most of the farmer are owner on their land by the law of inheritance i.e. they got the land ownership from their parents. So no need to take registry of land from their parents immediately and this incident is going on over the years. They also ignore to pay rent to the government of their land. As a result they have cannot apply for loan to

banks and they go to the non-institutional sources of credit such as money lender, trader, relatives etc. for their required loan and paying higher rate of interest. Banks are providing credits at minimum rate of interest on several schemes such as purchase machineries, fertilizers, pesticides etc. But uneducated farmers are not aware about that. Few educated and aware farmers are enjoying these services. Not only that many times government waive the burden of loan totally on account of crop failure due to drought, flood and for other calamities. So who had taken loan they got benefits of such waiver of loan schemes. Similarly, farmers can take suggestions from different government help lines about their crops over telephone. So education not only provides proper knowledge of farming but also expand the opportunities of different amenities delivered by government.

Now we shall test our Null Hypothesis (H_0) which is whether is not any impact of farmers' education on agricultural mechanization by using ANOVA test. For that we have classified level of education of farmers in to four categories. On the basis of this education we got households who are using different farm machineries. In the case of our previous hypotheses we found that use of farm machinery depends on landholding and access of credits. Here we shall to make relation between education of farmer and extent of farm mechanization.

In the following Table we have shown access of farm machineries according to level of education of farmers. It is worth mentioning that awareness of schemes on farm machineries provided by government is an important matter to have machines of farmers. Educated farmer can easily purchase big farm machineries by taking loan from banks at subsidies rate.

Table 6.20: Use of Farm Machineries on the Basis of Level of Education in Dakshin Dinajpur District

Machineries	Level of education in Dakshin Dinajpur district			
	Less than class V	Class V to < class X	Class X to < class graduate	Class graduate and above
Tractor	64	7	6	2
Rotavator	29	4	4	2
Power tiller	52	2	2	2
Thresher	34	6	4	2
Pump set	102	7	7	4
Sprayer	101	6	7	4
Combine harvester	7	3	1	0
Leveler	29	4	4	2

Source: Field survey

In our ANOVA Table we can see that calculated value is 15.322 which is higher than Table values at both 0.05 per cent and 0.01 per cent level of significance which are 3.34 and 5.45 respectively. That means across the farmers' education level farm mechanization is different. So our Null Hypothesis (H₀) where we have considered that across the farmers' education farm mechanization does not change has rejected and Alternative one which farm mechanization varies with level of education of farmers is accepted.

Table 6.21: ANOVA Test for the Relation between Level of Education and Agricultural Mechanization in Dakshin Dinajpur District

ANOVA

machine	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13987.844	3	4662.615	15.332	.000
Within Groups	8514.875	28	304.103		
Total	22502.719	31			

The relation between farmers education and agricultural mechanization of Bardhaman district has been shown in the following Table. We can see that education level is better in Bardhaman district compared to Dinajpur district. Total 59 households belong to class X to

less than graduate in Bardhaman whereas this number is only 7 in Dinajpur district. So it is expected that farmers of Bardhaman are having more mechanized agriculture compared to Dakshin Dinajpur.

Table 6.22: Use of Machineries on the Basis of Level of Education in Bardhaman District

Machineries	Level of education in Bardhaman district			
	Less than class V	Class V to < class X	Class X to < class graduate	Class Graduate and above
Tractor	10	8	20	2
Rotavator	29	15	54	7
Power tiller	12	10	29	2
Thresher	29	18	59	9
Pump set	34	18	59	9
Sprayer	32	18	59	9
Combine harvester	01	5	10	3
Leveler	30	17	57	8

Source: Field survey

Result of ANOVA test on the relation between farmers' education and level of farm mechanization is shown below. We found that Table values for levels of significance, 0.05 per cent and 0.01 per cent level of significance which are 3.34 and 5.45 less than calculated values which is 13.80. It implies that across the farmers' education level of agricultural mechanization is different in Bardhaman district.

Table 6.23: ANOVA Test for the Relation between Level of Education and Agricultural Mechanization in Bardhaman District

ANOVA

machine

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6278.500	3	2092.833	13.809	.000
Within Groups	4243.500	28	151.554		
Total	10522.000	31			

In above test we find that there is a relation between farmers' education and farm mechanization. But it cannot be concluded that level of farm mechanization will increase across the level of farmers' education exclusively. Because agricultural mechanization depends on also farm credits and level of landholdings. But after observing the statistics of level of education and use of machineries we can give one statement that across the education level agricultural mechanization will increase. It is worth mentioning that farmers who are educated they can receive different facilities of farming provided by governments. On the other hand, educated farmers cultivate more scientifically by using different farm ingredients. They are aware about benefits of machineries and purchasing criteria of such machineries on which huge subsidy is provided by government. Similarly, farmers who are educated they are taking help of KCC (Krisan Credit Card) to pursue the farm credits from banks. It has been found that farmers of Bardhaman are more educated than Dakshin Dinsjpur and KCC used by the farmers of Bardhaman in large extent. In the following Table we are proving some data on KCC holders of two districts.

Table 6.24: Number of Bank Account Holder and KCC Holder of two Districts

Districts	Bank account holder		
	Number	Percentage	KCC holder
Bardhaman	88	73.33	56
Dakshin Dinajpur	56	46.67	16

Source: Field survey

From the above Table we can see that number of bank account holder is higher in Bardhaman compared to Dakshin Dinajpur. This number is 88 and in percentage it is 73.33 in Bardhaman. But in Dakshin Dinajpur only 46.67 percent farm households are account holders but all of them do not take loan from banks for agricultural purpose. Similarly, it is revealed that 56 farm households in Bardhaman have KCC whereas this number is only 16 in Dakshin Dinajpur district. So we can conclude that more or less there is a positive relation between farmers education and farm mechanization.

**Table 6.25: Number of KCC Holder on the Basis of Level of Education in Dakshin
Dinajpur**

Level of Education	Total number of household	KCC holder	
		In number	In percentage
Less than class V	102	8	7.83
Class V to less than class X	7	3	42.86
Class X to less than graduate	7	3	42.86
Above graduate	4	2	50
Total	120	16	13.33

Source: Field source

The above Table 5.U shows user of KCC holder in number and in percentage according the level of education of Dakshin Dinajpur district. It has found that as level of education is increasing user of KCC has been increasing gradually. Only 7.83 percent farmers whose education level is less than class V is using KCC to get facility of loan from bank whereas 42.86 percent farmers whose level of is class V to less than class X. Similarly, farmers who are graduate among them 50 percent are KCC holder. So, the above data shows the positive relation between level of education and KCC holder in farm sector. It will be more clear if we use the correlation coefficient of the above data.

Correlations

		Household_number	KCC_holder
Household_number	Pearson Correlation	1	.989*
	Sig. (2-tailed)		.011
	N	4	4
KCC_holder	Pearson Correlation	.989*	1
	Sig. (2-tailed)	.011	
	N	4	4

*. Correlation is significant at the 0.05 level (2-tailed).

The above correlation Table shows that there is positive correlation between number of households according to education level and number of KCC holders. We can see that value of Pearson correlation is .989 which denotes that there is positive relation between the variables. Similarly, we found that the p value is .011 i.e. this correlation is statistically significant at the 0.05 level of significance.

Table 6.26: Number of KCC Holder on the Basis of Level of Education in Bardhaman

Level of Education	Total number of household	KCC holder	
		In number	In percentage
Less than class V	34	3	8.82
Class V to less than class X	18	9	50
Class X to less than graduate	59	39	66.10
Above graduate	9	5	55.56
Total	120	56	46.67

Source: Field survey

In the above Table 5.V we have shown number of KCC holder on the basis of level of education in Bardhaman. Here we can see that across the level of education of farmers number KCC holder has been increasing i.e. there is positive correlation between level of education and number of KCC holder. One another finding we revealed that number of KCC holder is quite large in Bardhaman compared to Dakshin Dinajpur district since the level of education is quite good in Bardhaman district. The following Table shows the correlation between above two variables of Bardhaman district.

Bardhaman

		Correlations	
		Household_number	KCC_holder
Household_number	Pearson Correlation	1	.839
	Sig. (2-tailed)		.161
	N	4	4
KCC_holder	Pearson Correlation	.839	1
	Sig. (2-tailed)	.161	
	N	4	4

In the above correlation Table we can see that households according to level of education and KCC holders are positively correlated in Bardhaman district. We can see that the Pearson correlation value is 0.839 i.e. the variables are positively related. Here also we have found that the p value is 0.161 which indicates that the relation is not strong enough.

**Table 6.27: Use of Farm Machineries on the Basis of Level of Education in Dakshin
Dinajpur District**

Machineries	Level of education in Dakshin Dinajpur district									
	Less than class V		Class V to < class X		Class X to < class graduate		Class graduate and above		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Tractor	64	62.74%	7	100%	6	85.71%	2	50%	79	65.83%
Rotavator	29	28.43%	4	57.14%	4	57.14%	2	50%	39	32.5%
Power tiller	52	50.98%	2	28.57%	2	28.57%	2	50%	58	48.33%
Thresher	34	33.33%	6	85.71%	4	57.14%	2	50%	46	38.33%
Pump set	102	100%	7	100%	7	100%	4	100%	120	100%
Sprayer	101	99.01%	6	85.71%	7	100%	4	100%	118	98.33%
Combine harvester	7	6.86%	3	42.85%	1	14.28%	0	0%	11	9.16%
Leveler	29	28.43%	4	57.14%	4	57.14%	2	50%	39	32.5%

Source: Field survey

*Total household having education < class V =102. ** Total household having education up to class V to < class X =7. *** Total household having education up to class X to < graduate =7. ****Total household having education up to class graduate and above =4

In the above Table we have classified the farmers according to level of education to show the use of farm machineries on the basis of education level. Here we can see that most of the farmers are belongs to lower level of education having less than education of class V. Total 102 farmers out of 120 found belongs to that category and among which 62 per cent farmer are using tractor, 28 per cent are using rotavator, 50 per cent are using power tiller etc. In case pump-set and sprayer which are small machinery we found 100 per cent and near 100 per cent user under same level of education. So we can conclude that education is not a factor to use of small farm mechineries. In this way we can see that as level of education increases percentage of farm machinery user also increase in most of farm equipments.

Table 6.28: Use of Machineries on the Basis of Level of Education in Bardhaman District

Machineries	Level of education in Bardhaman district									
	Less than class V		Class V to < class X		Class X to < class graduate		Class Graduate and above		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Tractor	10	29.41%	8	44.44%	20	33.89%	2	22.22%	40	33.33%
Rotavator	29	85.29%	15	83.33%	54	91.52%	7	77.77%	105	87.5%
Power tiller	12	35.29%	10	55.55%	29	49.15%	2	22.22%	53	44.16%
Thresher	29	85.29%	18	100%	59	100%	9	100%	115	95.83%
Pump set	34	100%	18	100%	59	100%	9	100%	120	100%
Sprayer	32	94.11%	18	100%	59	100%	9	100%	118	98.33%
Combine harvester	1	29.41%	5	27.77%	10	16.94%	3	33.33%	19	15.83%
Leveler	30	88.23%	17	94.44%	57	96.61%	8	88.88%	112	93.33%

Source: Field survey

*Total household having education < class V =34. ** Total household having education up to class V to < class X =18. *** Total household having education up to class X to < graduate =59. ****Total household having education from graduate and above =9

The above Table shows the same classification of farmers for Bardhaman district. It is very important to notice that level of education of farmers is quite good of this district. We can see that as level of education increases the user of farm machineries also increases. The main reason behind that is the educated farmers are opened account in bank to issue Kisan Credit Card to get direct benefit of farming provide by government.

V. SUMMARY

In this chapter we have seen that landholding determine the agricultural mechanization. Big machineries such as combine harvester, rotavator, tractors etc. required large holding. So if landholding is small it is not possible to such machineries. Taking into consideration this matter we can conclude that there is a positive relation between the level of landholding and farm mechanization. To prove it we have used ANOVA test and number of tables and diagrams and found the positive relation between the variables. Similarly, we have seen that access of farm credit determine the farm mechanization. Here also we have used the same technique and found the positive relation between access of credit and extent of farm mechanization. Finally, we have examined the relation between levels of education and extend of farm mechanization. To this hypothesis we have used correlation coefficient technique along with ANOVA test. By using ANOVA we found that education determine farm mechanization and correlation coefficient shows us there is a positive relation between farm mechanization and level of education.