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ADOPTION OF SELECTED AGRICULTURAL INNOVATIONS, TECHNOLOGY AND IMPROVED/MODERN FARM PRACTICES AND THEIR RELATIONSHIP WITH SOCIO – ECONOMIC CHARACTERISTICS IN A RURAL BLOCK IN WEST BENGAL, INDIA

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ABSTRACT

Farming community is at a crucial state of transformation both in farming activities as well as in their social life. Farm power and material possession show a clear indication of such change. Nuclear family concept is evident. Draught animals rearing are also going to be diminished. Irrigation and pest management equipment are found plenty. Bullock cart is totally extinct instead they are using Tricycle Van and Tractor drawn Trolley as means of conveyance of farm articles. Possession of Mobile Telephone, Bicycle, Television are most common. They are also not far away in utilisation of LPG for cooking purpose. They adopted more the modern farm practices followed by adoption of improved variety of crops then pest and nutrient management and have comparatively less interest in the adoption of organic farming. Study signifies that different socio-economic attributes of the farmers plays very important and dominant role in the adoption of different agricultural technologies, practices and innovations of the farmers. Regression analysis shows that material possession, annual income, age, education etc have strong and direct effect on adoption of different innovations. Study indicates that farmers' material possession especially electronic gadgets surpass the possession of farm power which hint at the contraction of farm infrastructure which might have direct bearing with the farm productivity.

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INTRODUCTION

The adoption of new technologies and modern practices in agriculture are indispensable one to provide adequate food to all people in our country. High yielding varieties seeds, chemical fertilizers, mechanization of farming, intensive cultivation, chemical pesticides etc. are not far away to avail in Indian agriculture. It is the actual adoption of those techniques and technologies in the farmers' field to result in more harvest. Gurudev Rabindranath Tagore once mentioned that *'It is not his own physical strength but the use of tools that has*

*Part of Ph. D. Thesis by the first author.

helped man to get the best out of cultivation....'

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So it is needless to mention that how important is, the adoption in the field of agriculture. 'But it will not help merely to theorise; the right answers must be found through actual practice. Agriculture in India has come across a long journey from its traditional bartering system to commercial and contract farming. With the advent of Green Revolution its productivity increases manifold. It's the Globalisation and Open General Trade which again opened its door to the and for the entire world to act with. In that backdrop are the farming communities at present scenario actually in better position in socio-economic and other social positions and in their well beings? Are they in right trend of adopting the modern farm innovations and able to sustain in the present open market system? A study is conducted to look at the socio-economic characters and adoption of modern agricultural innovations of the farmers of Jamalpur, a rural block in Burdwan, West Bengal. Adoption of improved agricultural innovations and practices has attracted the

attention of research workers in extension education since long. The adoption of innovation was described by Barnett (1953) at the psychological level and conceived innovation as basis of cultural change. Of the persons who studied behavioral aspect of adoption of improved agricultural practices, mention may be made of Blanckenburg (1972), Kunnal *et. al.* (1984), Mann (1989), Juliana *et. al.* (1991), Nikhade and Linbika (1992), Perz (2003), Reddy (2006), Sen and Bhatia (2004), Knowler *et. al.* (2007) as a few. In the present study, adoption refers to the acceptance and use of improved agricultural technology and practices. Wilkening (1953) described the adoption of an innovation as a process composed of learning, deciding, and acting over a period of time. According to Johnson and Haver (1955) adoption is essentially a decision making process. Diffusion of innovation is defined by Rogers (1962) as the process by which an innovation or new idea spreads from its source or creation to its ultimate users or adopters. Rogers and Shoemaker (1971) defined adoption as one of the consequences of the innovation-decision process.

MATERIALS AND METHODS

The present study is not related to any specific operation, practice, technology or innovation, rather it is a drive to assess the farmer's perception on modern agricultural technology, operation, schemes, practices and innovations. Therefore adoption was measured by the adoption index method developed by Bhattacharjee (1997). Selection and list of improved/modern farm practices, technology & innovations, therefore, prepared keeping in view the latest schemes and missions in operation by the Government departments, NGOs, Private & Public Sector Corporate and the products that are available in the market and accessible to the farmers.

RESULTS AND DISCUSSION

Greater number of farmer respondents belongs to the age group 41-50 years and they are Hindu by religion, mostly married male.

Table 1. Variables selected for study and their measurement

Sl. No.	Variables	Measures
A.	Dependent Variables (Y)	
	i) Adoption of Improved Varieties of Crops.	Adoption Index Method, Bhattarjee(1997)
	ii) Adoption of Modern Agricultural Practices	
	iii) Adoption of innovations towards Integrated Nutrient Management	
	iv) Adoption of innovations towards Integrated Pest Management	
	v) Adoption of Organic Farming	
	vi) Adoption of Modern Agricultural Technology	
B.	Independent Variables	
(a)	Socio - economic	
	Age(X1)	Schedule developed
	Annual Income(X2)	Socio-Economic Status Scale-Rural (Pareek and Trivedi,1964)
	Occupation(X3)	
	Caste(X4)	
	Education (X5)	
	Family Type(X6)	
	Family Size(X7)	
	Land(X8)	
	House Type(X9)	
	Farm Power(X10)	
	Material Possession(X11)	
	Economic Motivation(X12)	Self-rating Economic Motivation Scale (Moulik,1965)

Table 2. Different agricultural Innovations, Practices & Technology and Techniques

Sl. No.	Name of the Innovation/Practice
A.	Adoption of Improved Varieties of Crops.
1	Use of Certified Seeds in every season
2	Whether High Yielding Varieties(HYV) of crop are grown
3	Ever cultivated Hybrid seeds of vegetables
4	Ever cultivated Hybrid seeds of crops
5	Cultivate potato using recommended varieties by CPRI
6	Cultivate using HYV duly recommended by the Department of Agriculture, Govt. of West Bengal.
B.	Adoption of Modern Practices
1	Followed the practice of crop rotation and using one pulse/legume crop every year
2	Do you sow crop like jute, wheat, Rice etc. in line sowing
3	Whether maintain definite number of plant per unit area
4	Paddy cultivation following the method of SRI
5	Use of Drum Seeder for sowing of Rice
6	Do you irrigate the crop in time according to biological cycle and sufficient water supply
7	Do you always harvest the crop in proper time
8	Drying, Sorting and grading of seeds and/or commercial harvest before storing.
9	Do you apply herbicide to control weeds

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C.	Adoption of Innovation towards Integrated Nutrient Management
1	Soil Testing before crop season
2	Whether apply Lime or Sulphur on the basis of Soil testing
3	Use N P K fertilizer in balance dose as per Soil Testing Report
4	Use of slow release Nitrogenous fertilizer or use of Neem Oil with Nitrogenous fertilizer
5	Integrated Nutrient Management by combining Organic Manures with Chemical fertilizer
6	Use of Micro Nutrient and Sulphur in Soil before sowing of the crop.
7	Applied Micronutrient as spray or other form in standing crop as deficiency symptom shown
D.	Adoption of Innovation towards Integrated Pest Management
1	Seed Treatment before sowing/planting
2	Seedling root dip with pesticides before transplantation/planting
3	Whether used light trap /Pheromone trap for control of flying insects.
4	Use of Trichoderma(Trichor) as Bio- control agent in plant disease control agent
5	Use of Knap Sack Sprayer for spraying of Plant Protection Chemicals.
6	Use of Power Sprayer for spraying of Plant Protection Chemicals.
7	Apply 300 litres or more water per acre for high volume spraying
8	Whether percentage of pest or disease infestation or loss was evaluated before application of plant protection chemicals
9	Whether resistant varieties of particular crop were grown
10	Whether appropriate and specific chemicals were applied
E.	Adoption of Organic Farming
1	Cultivation through only Organic Fertilizer
2	Growing Blue Green Algae(BGA) in Rice field
3	Whether mixed Rhizobium culture with the seeds of Ground Nut and Pulse crops before sowing
4	Used Bio- Fertilizer like Azophos, RizophosEtc
5	Whether grow Dhaincha/ Sunhemp etc. for Green Manuring
6	Making of compost at farm from crop residue and household westage
7	Used Vermicompost in the field
F.	Adoption of Modern Technology
1	Do you take advice from Krishan Call Centre for farm related problems
2	Are you taking crop loan using Krishan Credit Card
3	Do you get benefit of crop insurance in case of crop failure
4	Do you ever produced certified seeds in Seed Village Mission scheme
5	Application of Zero Tillage Technology in Rice, Wheat or other crops.
6	Ploughing of the field using Power Tiller or Tractor and Tractor driven Rotor /Rotavator
7	Use of sprinkler and/ or Drip system of Irrigation machineries or practices.
8	Application of combined Harvester Thresher for harvesting of crops
9	Use of Conoweeders/ Power Weeder for control of weeds
10	Used Paddy Thresher
11	Have you heard the name of/ever attend Farmers' Field School

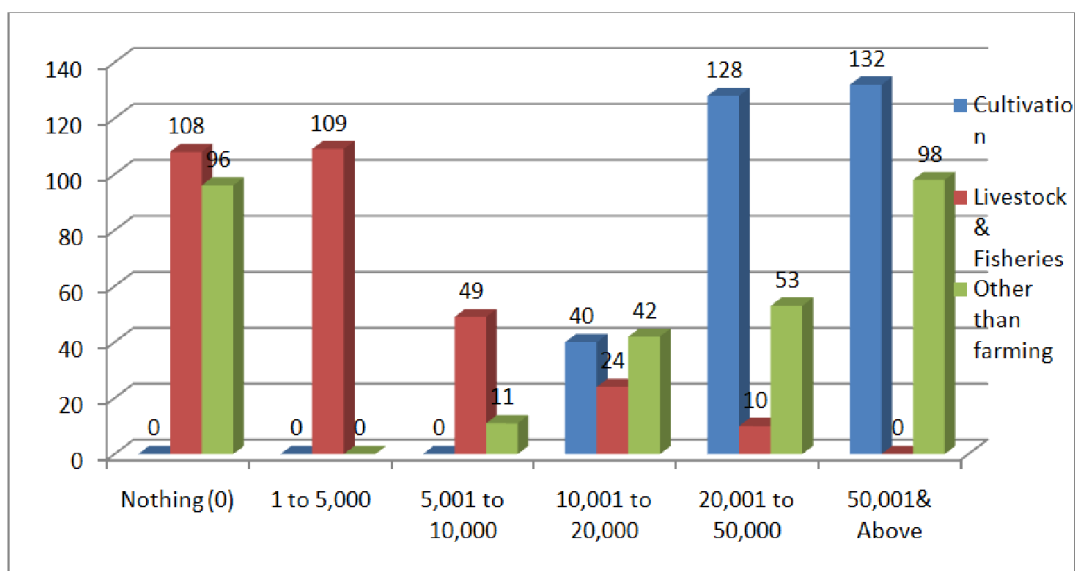


Fig. 1. Comparative chart of different Income Sources (Population size 300)

Majority of the farmers have total annual income in the range of Rs. 60,000/- to 1,50,000/-. Majority of the farmers are having high school level education. Nuclear family concept is most prevalent. 64% of the respondents belong to single family.83.3% of the farmers have sibling less than two.

Amongst the 279 farmers who are father of child only 156 persons are the father of girl child against 236 farmers, a father of boy child. In both the cases single boy and single girl feature is most dominant. Majority of them possess upto one hectare of land. Most of them belong to agricultural caste and

took the cultivation as their occupation. Though the area under survey is in rural Bengal but the majority farmers have pucca house. In this study it is noticed that 16.7 and 49 percent farm family do not possess any farm power and 49 percent farm family do not have at least single draught animal though performing farming activity while 50 percent farmers have only two draught animal. 18.33 percent farmers possess power tiller and it is reported that those who have no power tiller they simply hired the same from the neighbouring farmer who possess power tiller and used to employ the same on rental basis at leisure time, for the purpose of tilling and land preparation. Rearing of draught animal seems to be burden to a considerable number of farm families as it was found that there were no draught animal amongst 50% of the respondents. Irrigation and pest management appears to be the priority area in the farming community as the possession of pump set and sprayer machine is in abundance amongst them as the important farm power.

On the other hand there is seldom any farmer who has no Mobile phone or Bicycle. While more than 30 percent farmers possess Van-rickshaw there is not a single farmer who have bullock cart. It is observed that 41.3 percent farmers possess radio transistor but farmer having television set in their house totaled to be 88.6 percent of which colour television alone is 83.3 percent. More than fifty percent farmers are having motor cycle as their conveyance and 65.7 percent household have their food cooked utilizing LPG connection. There are farmers in the rural block of Jamalpur who are tech-savvy enough to have access to internet. From the data of the material possession there is a clear indication that the famers in the study area are not indifferent to the wave of consumerism and they are well adapted to mobile phoning, color television with cable connection, internet connectivity, LPG, motor cycle and refrigerators in their house. Possession of all these materials and utilization of such facilities always related to suffering regular expenditure.

Table 3. Descriptive Statistics of some variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	300	20.00	60.00	39.6	9.23
Annual Income	300	15000.00	>1,50,000.00	N A	NA
Occupation	300	1.00	6.00	4.27	1.25
Caste	300	1.00	6.00	3.42	1.33
Education	300	1.00	6.00	4.70	1.15
Family Type	300	1.00	3.00	1.40	.57
Family Size	300	1.00	2.00	1.18	.38
Land	300	0.00	3.00	1.99	.84
House Type	300	1.00	6.00	3.59	1.19
Farm Power	300	0.00	6.00	1.67	1.28
Material Possession	300	1.00	5.00	2.86	1.10
Economic Motivation	300	1.00	5.00	2.39	1.23

Table 4. Adoption of Agricultural Innovations, Technology and Practices (N= 300)

Dependent variables	N	Minimum	Maximum	Mean	Std. Deviation
Adoption of Improved Varieties of Crops	300	41.67	91.67	63.0547	12.92862
Adoption of Modern Farm Practices	300	50.00	83.33	71.6683	7.96771
Adoption of Innovation towardsIntegrated Nutrient Management	300	14.29	92.86	52.6424	20.35438
Adoption of Innovation towardsIntegrated Pest Management	300	40.00	80.00	57.1000	10.86971
Adoption of Organic Farming	300	0.00	78.57	33.2146	20.26326
Adoption of Modern Farm Technology	300	13.64	40.91	28.5891	8.92888

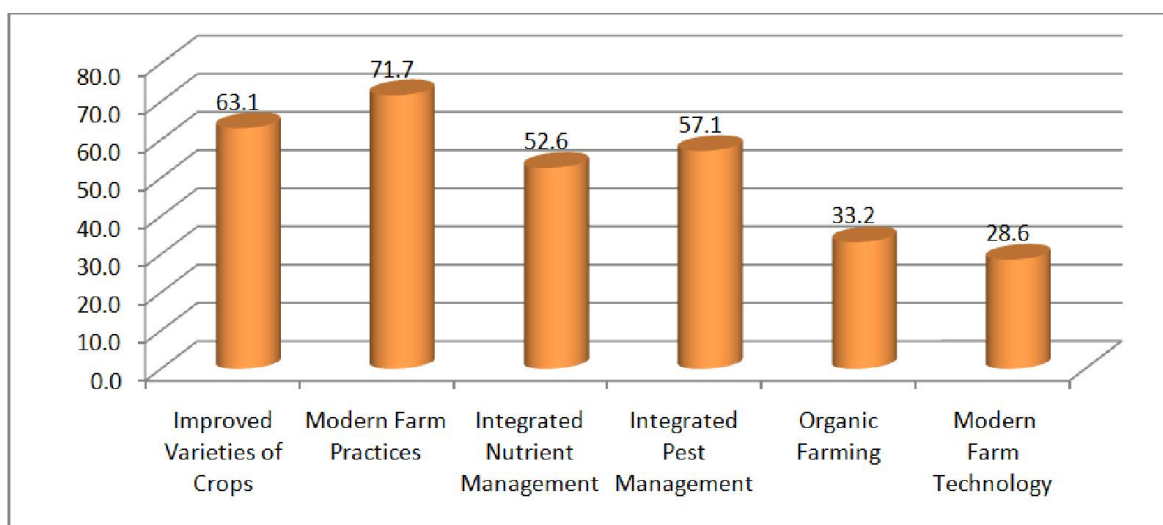


Fig. 2. Adoption Index (Mean) of Agricultural Innovations

Table 5. Mean effect of different independent variables on the dependent variables

Variables	Categories	Adoption of Improved Varieties of Crops.	Adoption of Modern Farm Practices	Adoption of Integrated Nutrient Management	Adoption of Integrated Pest Management	Adoption of Organic Farming	Adoption of Modern Farm Technology	
Age	20—30yrs	59.21	65.79	39.1	0.47	21.43	26.79	
	31-40yrs	59.08	72.06	47.76	0.46	28.46	26.19	
	41-50yrs	65.83	72.48	56.59	0.71	37.6	29.56	
	51-60yrs	63.71	70.69	53.95	0.63	32.89	29.67	
	>60yrs	55.56	77.78	50	1	33.33	27.27	
Chi-Square			19.376	24.938	18.137	18.33	14.877	9.462
Sig.			0.001	0	0.001	0.001	0.005	0.051
Family Income from Cultivation (in Rs.)	10,001 - 20,000	52.5	60.42	27.32	0	6.96	17.84	
	20,001 - 50,001	60.29	71.09	49.67	0.52	32.98	27.06	
	50,001 & Above	68.94	75.63	63.2	0.92	41.4	33.33	
Chi-Square			54.499	106.484	122.749	123.438	111.41	106.01
Sig.			0	0	0	0	0	0
Family Income from Livestock and Fisheries	Nothing	61.73	73.1	53.37	0.75	32.34	29.25	
	1 to 5,000	65.52	71.97	56.42	0.61	37.81	28.19	
	5,001 to 10,000	57.65	67.69	41.25	0.39	26.38	26.99	
	10,001 to 20,000	62.5	69.44	46.43	0.5	24.11	25.57	
	20,001 to 50,000	78.33	77.78	74.29	1	47.86	40.91	
Chi-Square			33.273	23.599	32.934	26.699	18.942	29.182
Sig.			0	0	0	0	0.001	0
Non-Farm Income (®)	Nothing	63.37	71.47	55.73	0.72	35.94	30.3	
	1 to 5,000	57.58	57.58	34.42	0	14.94	18.18	
	5,001 to 10,000	51.98	65.87	36.05	0.17	18.71	21.97	
	10,001 to 20,000	61.32	72.43	47.84	0.49	26.55	26.16	
	20,001 to 50,000	69.05	75.51	61.37	0.88	42.42	32.24	
Chi-Square			61.909	75.15	68.43	90.191	58.782	64.484
Sig.			0	0	0	0	0	0
Occupation	Labour	17.13	60.26	26.37	0	3.3	55.77	
	Caste Occupation	36.36	77.78	50	1	21.43	50	
	Business	30.41	75.13	55.36	0.79	33.67	63.69	
	Independent Profession	23.27	68.44	36	0.4	23.71	59	
	Cultivation	28.34	70.25	53.09	0.6	33.84	63.24	
	Service	32.75	75.16	66.6	0.71	48.95	67.65	
Chi-Square			44.177	55.437	63.446	39.304	54.976	12.136
Sig.			0	0	0	0	0	0.033
Caste	Scheduled Caste	30.56	71.26	56.65	0.59	38.42	65.66	
	Lower Caste	18.18	66.67	30.95	0	11.9	61.11	
	Artisan Caste	23.92	68.42	36.84	0.47	23.68	52.63	
	Agricultural Caste	28.97	72.07	54.9	0.65	33.66	63.92	
	Prestige Caste	31.25	73.61	48.66	0.81	40.18	59.9	
	Dominant Caste	24.09	73.89	42.86	1	20.71	58.33	

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Chi-Square		22.10	12.38	25.79	26.04	25.93	16.72
Sig.		.001	.030	.000	.000	.000	.005
Education	Can Read only	36.36	72.22	35.71	0.00	14.29	50.00
	Read & Write	25.52	65.38	44.51	0.46	24.73	59.62
	Primary	18.18	65.48	32.65	0.00	18.37	55.36
	Middle	22.56	66.26	41.43	0.29	21.43	55.00
	High School	29.18	73.12	52.82	0.73	33.99	61.96
	Graduate & Above	35.94	76.54	70.11	1.00	48.40	74.78
Chi-Square		126.72	95.60	107.53	131.78	80.08	96.76
Sig.		.000	.000	.000	.000	.000	.000
Family Type	Single	27.53	70.37	49.29	0.60	28.01	60.85
	Joint	29.38	73.33	56.54	0.66	41.58	65.88
	Extended	38.46	78.63	73.63	0.69	48.90	75.00
Chi-Square		18.47	20.74	17.63	1.19	31.42	12.27
Sig.		.000	.000	.000	.551	.000	.002
Family Size	Upto 5 members	27.97	70.78	51.82	0.61	31.38	62.52
	Above 5 members	31.48	75.79	56.47	0.70	41.78	65.57
Mann-Whitney U		5195.50	4285.00	5558.50	5977.50	4428.00	5761.50
Wilcoxon W		35823.50	34913.00	36186.50	36605.50	35056.0	36389.50
Z		-2.44	-4.24	-1.74	-1.18	-3.72	-1.41
Asymp. Sig. (2-tailed)		.015	.000	.082	.237	.000	.159
House Type	Hut	18.18	50.00	21.43	0.00	0.00	50.00
	Kutch House	23.73	66.11	40.00	0.24	20.86	56.50
	Mixed House	23.14	69.70	45.45	0.38	24.51	56.63
	Pucca House	31.52	74.54	58.39	0.88	41.49	66.60
	Mansion	39.47	76.75	71.05	1.00	46.99	76.75
Chi-Square		131.75	85.49	92.34	116.37	93.45	88.19
Sig.		.000	.000	.000	.000	.000	.000
Land	No Land	50.00	50.00	21.43	0.00	0.00	18.18
	Upto 0.40 ha	58.94	67.71	44.35	0.33	25.52	23.11
	0.41 ha- 1.0 ha	59.42	70.44	45.86	0.56	29.43	27.50
	More than 1ha	71.17	77.56	68.64	1.00	45.71	35.36

Table 6 . Multiple Regression Analysis of different Agricultural Technologies, Practices and Innovations against Socio-Economic variables

Dependent Variables	Improved Varieties		Farming Practices		INM		IPM		Organic Farming		Farm Technology	
	B	Sig	B	Sig	B	Sig	B	Sig	B	Sig	B	Sig
Age	-0.064	0.316	-0.112	.031*	-0.217	.012**	0.25	.000**	-0.386	.000**	-0.143	.045*
Annual Income	0.293	.005**	0.419	.000**	0.368	.009**	0.415	.000**	0.088	0.516	0.148	0.202
Occupation	0.099	.032*	0.001	0.976	0.321	.000**	-0.072	0.093	0.393	.000**	0.117	.024**
Caste	-0.039	0.393	-0.028	0.454	-0.088	0.151	0.057	0.175	0.015	0.804	-0.233	.000**
Education	-0.106	0.108	-0.17	.002**	-0.253	.005**	0.225	.000**	-0.337	.000**	-0.168	.024**
Family Type	-0.145	0.385	-0.035	0.797	-0.012	0.957	0.061	0.695	0.034	0.877	0.12	0.518
Family Size	-0.313	0.154	-0.091	0.611	-0.815	.007**	-0.18	0.378	-0.202	0.481	-0.577	.019**
Land	-0.02	0.826	0.768	.000**	0.46	.000**	0.288	.001**	0.17	0.156	0.594	.000**
House Type	-0.109	0.183	-0.143	.033*	-0.292	.009**	-0.235	.002**	-0.024	0.822	-0.037	0.686
Farm Power	0.096	.027*	-0.008	0.819	0.092	0.117	0.055	0.17	0.03	0.592	-0.033	0.498
Material Possession	0.239	.011*	0.23	.003**	0.772	.000**	0.28	.001**	0.637	.000**	0.487	.000**
Economic Motivation	0.24	.000**	-0.024	0.574	0.302	.000**	0.307	.000**	0.244	.000**	0.077	0.189

Agriculture is a farm business which usually generate income at seasonal interval and as it is evident from different reports agricultural income of the farm families are decreasing day by day it may cause concern over the economic stability when the expenditure on account of other than farming especially on consumerism of recurring nature goes on increasing. Poverisation, farmers' indebtedness and agrarian crisis are the result for the imbalance of farming revenue and household expenditure that also an indication from the study. Amongst the different agricultural innovations studied it is found that the farmers adopted most the modern farm practices followed by adoption of improved variety of crops. They are also not far behind in pest and nutrient management as it is known to them that after seed next important aspect in farming is the nutrients and diseases pest where they show a positive trend in adoption of integrated nutrient management and integrated pest management. Farmers showed less interest in the adoption of organic farming and modern farm technology. Thus it is evident from the study that the farmers in one of the most agriculturally advanced block in West Bengal are most keen to adoption of agricultural innovations which have direct bearing and immediate impact on the production and productivity of crops.

It is found that 41-50 age group has higher mean effect than other age groups for adoption of integrated nutrient management, organic farming and improved varieties of crop whereas farmers of age more than 61 shows higher mean in case of adoption of improved farm practices and integrated pest management. Farmers of higher income group have more mean value than other income groups for affinity towards adoption. Farmers having caste occupation and service occupation have more mean value over other occupations for the adoptions. Farmers having education level graduate and above have highest mean value in respect of adoption of all the practices and innovation except modern farm technology for which lowest educational level farmers shows highest mean value. Extended family type with family members 5 and above has more mean value than other types and sizes. More the land holding, higher the house type, more the material possession more is the adoption as highest the category show highest mean over other categories.

Adoption Relations

- Regression analysis about the adoption of different agricultural practices, technology and innovations indicates that adoption of improved varieties of crops has significant positive and direct predictions with the variation of independent variables like annual income, occupation, farm power, material possession and economic motivation. It was observed that age, caste, education, family type, family size, land and house types have no significant relation with adoption of improved variety of crops.
- Regression analysis show that modern farm practices has significant and direct predictions with the variation of independent variables like age, annual income, education, house type land and material possession. While results show that every unit increase in independent variables like annual income, land and material possession show increase in dependent

variable modern farm practices, lower the denomination more the adoption in case of age, education and house type.

- Adoption of Integrated Nutrient Management has significant positive and direct predictions with the variation of independent variables like annual income, occupation, land, material possession and economic motivation where as age, education, family size, house type plays a significant, direct but negative impact on the adoption of Integrated Nutrient Management.
- Adoption of Integrated Pest Management has significant positive and direct predictions with the variation of independent variables like age, annual income, education, land, material possession and economic motivation.
- Adoption of Organic Farming has significant positive and direct predictions with the variation of independent variables like occupation, material possession and economic motivation. Where as age and education plays a significant, direct but negative impact on the adoption of organic Farming.
- Adoption of modern farm technology has significant, direct and positive relationship with occupation, land, material possession. An increase in the magnitude of these independent variables results in increase in the magnitude of adoption. Where as age, caste and education are the independent variables which have significant, direct relationship but negative values that means increase in magnitude of these variables results in decrease in adoption level.

Conclusion

Most of the farm families are single family type and 82.3% has family size up to five members. The findings suggest that 49% farm family do not possess any Draught animals. Possession of pump set and sprayer machine as farm power is in great quantity amongst the farming community. Bullock cart is totally absent. Use of Tricycle Van and Tractor are noted. Television possession is common in most of the households, even more than possession of Radio Transistor. Most of the farmer has in their possession Mobile Telephone. Motor cycle as personal conveyance, LPG Cylinder for cooking fuel are also noted in the area. They adopted more the modern farm practices followed by adoption of improved variety of crops, pest and nutrient management. Farmers showed comparatively less interest in the adoption of organic farming. Regression analysis of the dependent variables i.e. adoption of different agricultural technologies, practices and innovations with the independent variables established some significant relationship. Study signifies that different socio-economic, socio-cultural, psychological attributes and communication characteristics of the farmers plays very important and dominant role in the adoption of different agricultural technologies, practices and innovations of the farmers.

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