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EXPLORING DIVERSITY AMONG FARMERS IN ADOPTION OF AGRICULTURAL INNOVATION AND OPTIONS FOR SMALLHOLDER FARMING SYSTEM-A CASE STUDY OF AMBEDKARNAGER DISTRICT OF UP

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Abstract: Smallholder farmers occupy a prominent position in Indian agriculture. Against the background of increasing fragmentation of landholdings, these farmers are facing the challenge of securing their livelihoods within the context of a wide variety of socio-economic and political constraints. Consequently, every day a massive stream of rural people are migrating to urban centres. A sustainable and dynamic approach to smallholder farmers' deplorable condition is a matter of great concern and priority for discourse for balanced social development. This study, based on cross-sectional survey of 1243 farm households to assess the cropping pattern, off-farm activities of the farmers, and their adoption to agricultural innovations. Employed a stepwise multiple linear regression model to identify which factors and to what extent influence the adoption bahaviour of farmers. The results demonstrate nearly 98% positive influences of size of land holding, economic condition, education and farm ownership on adoption behaviour of farmers. The study also reveals that fragmented landholdings are major hindrance in adoption process. Diversification of agriculture in favour of high-value commodities is suggested for sustainable development of smallholder farmers.

Key words: Small holder farmer, Ambedkarnagar, Adoption of innovation, Agriculture.

INTRODUCTION

Agriculture being the most important human economic activity continues to be a fundamental instrument for reducing food insecurity, poverty and social inequality. Three out of every four poor people in developing countries live in rural areas (UN 2007) which mainly depend on agriculture for their livelihood. Like the other developing countries, India is also predominantly an agricultural country provides livelihood to two-thirds of the population, gives employment to around 52% of the workforce, and accounted for 15.7% of the gross domestic product in 2008-09 (Economic Survey 2009-10).

The agricultural sector in Indian is dominated by large number of marginal and small farmers (GOI 1997; NSSO 2006). It is estimated that >80% of the farmers belong to marginal and small farm size groups, owing or operating <1.0 hectares or 1.0-2.5 hectares of land respectively. Out of the country's 116 million farmers, around 60% have <1 hectare and together they farm 17% of the land. The share of medium to large farms (above 4 hectares) is very small at just over 7% of all holdings, but these farms account for around 40% of the land (NCEUS 2008). The small holding character of Indian agriculture is much more perturbing and pertinent today than ever before. Due mainly to sub-division of land holding on inheritance basis, land reform policy and neo-liberal policies that prescribed concentration of land through purchase or leasing in by big landowners in the name of private firms (Ramachandran and Ramakumar 2000; Athreya 2003), the share of marginal and small farmers has seen substantial increase over period of time, not only in terms of numbers of farmers and holdings but also more significantly in terms of owned and operated area. The share of marginal and small farmers in owned land went up from 16.3 per cent in 1953-54 to 43.5 per cent in 2002-03 whereas the operational holdings increased from 61 per cent to 80 per cent during the same period of the study (NCEUS 2008). The implication is that the farmers are not going to sustain their livelihood

from the fragmented land left with them. Declining size of farm coupled with a number of constrains like rising cost of cultivation, lack of institutional loan facility or high interest rate on loan, low remunerations, high risks with frequent crop failures, declining agricultural growth, mounting debts and natural calamities have all led the small and marginal farmers to a distress like situation (Chawla et al 1989; Assadi 1998; Chavan 2007; Posani 2009). Furthermore, due to small operational holdings, it is indeed very difficult for them to adopt new technologies effectively and to improve their economic conditions by cultivating the existing crops, mainly cereals. Besides, the reducing role of public policies and programmes, insufficient government interventions, increasing market integration, globalization and liberalization has also enhanced the inherent disadvantage facing by small and marginal farmers. As a result, they are leasing and selling out their lands to the big farmers as the adoption of agricultural support technologies are tied with the large size of land holdings, and making exodus migration from rural to urban areas or taking extreme step like committing suicide (Misra 2007; Nagappa et al 2010), giving way to socio-economic and regional imbalances.

Therefore, grow more food grains at national level is not all an issue, but to obtain sustainable livelihood from the continued fragmented land holding and development of small and marginal farmers is a major challenge in the pursuit of sustainable development. Although these issues have been analyzed in-depth by the National Commission of Farmers (NCF) and subsequently a National Policy of Farmers has been adopted by the government of India (GOI). But unfortunately, despite launching various special schemes and programmes, problem of the farmers continues to be increasing and the benefits of all such schemes and programmes have not been percolated down to reach these farmers who deserve the most and for whom they were launched due to their faulty implementation. Various strategies like the integration between small and marginal farmers with large size of landholders in adoption of higher remunerative crops, increase the size of land holding by distributing surplus of culturable waste lands or increase their income by introducing the high value commercial crops strategies seem to be laudable but how far applicable, requires intensive study.

Ambedkar Nagar, one of the districts of eastern Uttar Pradesh, which is agriculturally as well as industrially backward, is selected for intensive studies. It was created from Faizabad division on September 29, 1995 and named after Dr. Bhim Rao Ambedkar, covers an area of 2,361 sq.km. (District Gazetteer 2001). The district lies between 26º 09' N to 26º 40' N latitude and 82º 12' E to 83º 05'E longitudes. It is bounded on the north by Basti and Santkabir Nagar districts, on the north-east by Gorakhpur district and on the south by Sultanpur district, on the west by Faizabad district and on the east by Azamgarh district. Whole district is divided into nine development blocks namely Akbarpur, Katehari, Bhitti, Tanda, Baskhari, Ramnagar, Jalalpur, Jahangirganj, and Bhiyaon (Fig.1).

Nearly 91% of the total populations are engaged in agriculture and majority of them are small and marginal farmers. They constitute 86% holding and more than 75% of the total cultivated land. Since the farming is their main economic activity, sale of crop products and livestock is the only source of cash income. A limited number of farmers generate off-farm income in the study area. Therefore, promoting agriculture through the sustainable management of small and marginal landholdings is imperative for socio-economic transformation and equality. The article is structured as follows. First we assess the cropping pattern, adoption of agricultural innovation, and the involvement of farmers in off-farm activities with reference to different sizes of landholders to properly envisage plan for their sustainable livelihood. Then analyze which factors and to what extent influence the adoption of agricultural innovation by the farmers of different size of landholding to chalk out proper strategy to improve their income prospects. Thereafter, we explore income earning opportunities in farming sector in order to strengthen the livelihood security of the farmers. The study is based on hypothesis that there is a positive relationship between socio-economic condition of the farmers' and adoption of innovation.

Adoption of Innovation: A Conceptual Framework

An innovation is an idea, practice, or object that is perceived as new or an improvement over the existing one by the individual or members of a society. It represents a slight modification or a significant departure from the existing idea or practice. Most agricultural innovations manifest into mechanical innovations (tractors and combines), biological innovations (new seed varieties), chemical innovations (fertilizers and pesticides), agronomic innovations (new management practices), biotechnological innovations, and informational innovations (Sunding, and Zilberman 2000). Farmers themselves may develop some new practices, which are also considered as innovations (Turmeric intercropped with maize in Karimnagar and Nizamabad districts of Andhra Pradesh is a farmer innovation).

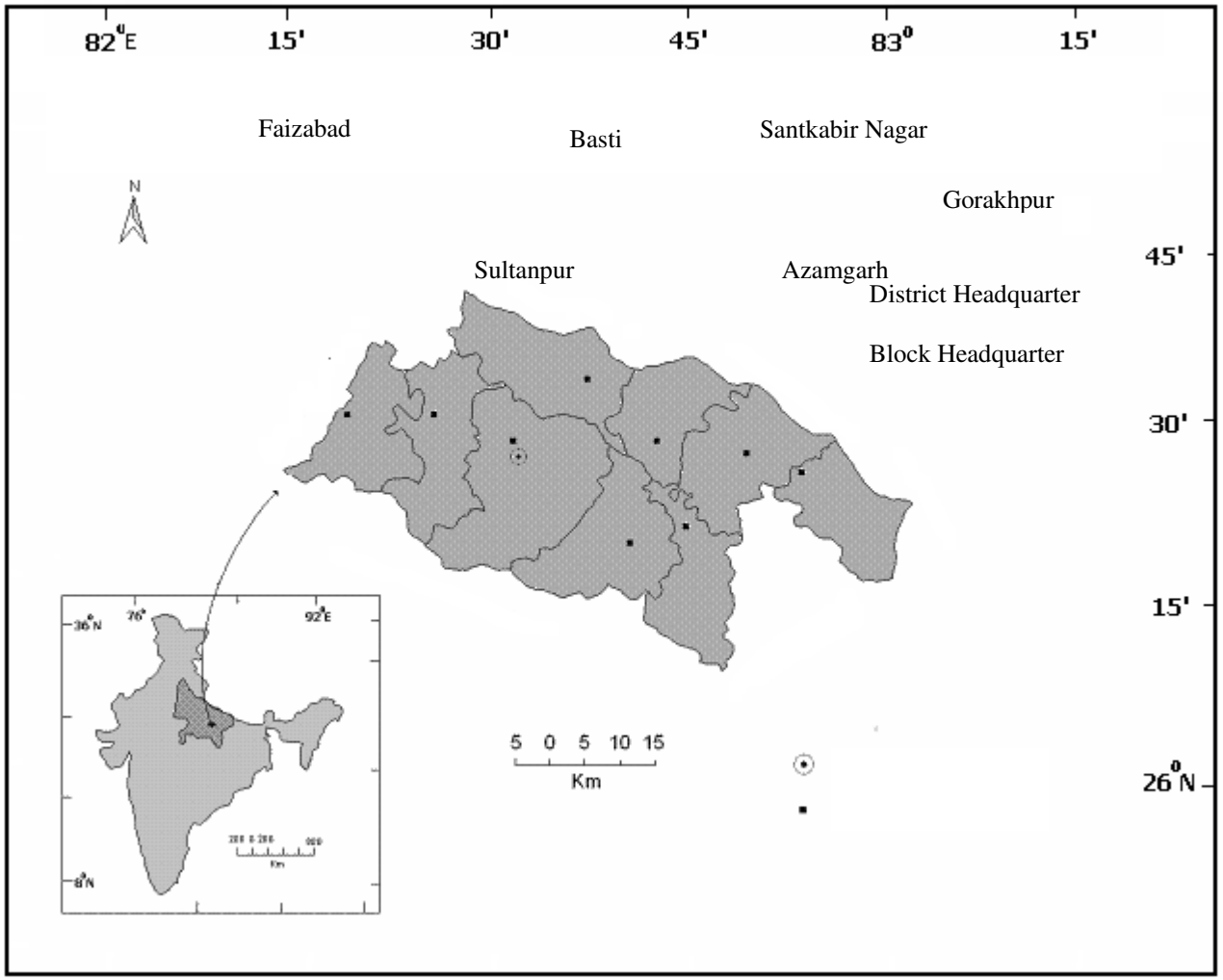

Figure 1: Location of the Study Area

An innovation diffuses within a social system through its adoption by individuals and groups over a period of time (Rogers 1995). The decision to adopt an innovation, however, "is not normally a single, instantaneous act"; it involves a process passing through a number of mental stages before making a final decision to adopt an innovation. The sequence of stages is: (1) Awareness (2) Interest (3) Evaluation (4) Trial and (5) Adoption. The same five stages do not occur with all the adopters and all the practices sequence is not always the same. Some times one stage appears more than once. In some cases some stages are so short as to be imperceptible, and in other cases some stages seem to be skipped. Each stage of adoption process is determined by number of factors, including household factors (education level, monthly income, age and family structure, religion, farm size, farm ownership, caste, exposure to outside contacts, value and attitude), community factors (access to extension, market, infrastructure, indigenous knowledge and ecological factors), and institutional factors (extension services, training and material support through government and national/local NGOs) (Beshah, 2003; Rasul & Thapa 2004; Pender et al., 2006; Bewket, 2007). The magnitude and intensity of these factors may vary from one place to another with variations in the agro-ecological, socio-economic and institutional settings (Bekele & Drake, 2003). Apart from it, different attributes of innovation like relative advantage, compatibility, complexity, tryability, observability, predictability, and preventive innovation determines the adoption rate of innovation.

S. No.	List of Variables
A.	**Basic characteristics of the respondents**
1	Age- 15-30, 31-45, 46-60, >60
2	Sex- M/F
3	Education Level- Below Xth, Xth, XIIth, Graduate, Professional or illiterate
4	Occupation- only farming, farming+ Job, farming+ business
B.	**Monthly Income of the Family**
1	Income from agriculture sector – Rs. < 1000, 1001-2000, 2001-3000, >3000
2	Income from self-employment non-farm sector – Rs. < 1000, 1001-2000, 2001-3000, >3000
3	Income from Govt. service (if any) – Rs. < 1000, 1001-2000, 2001-3000, >3000
4	Income from private service (if any) – Rs. < 1000, 1001-2000, 2001-3000, >3000
5	Income from livestock (if any) – Rs. < 1000, 1001-2000, 2001-3000, >3000
6	Income from leased out/rented land or equipment (if any) – Rs. < 1000, 1001-2000, 2001-3000, >3000
C.	**Land Holding Characteristics**
1	Status of the farming land-own/leased
2	Size of farming land (hectares)-<1, 1-2, 2.1-3, 3.1-4,>4
3	Gross cultivated area (hectares)- <2, 2-4, 4.1-6,>6
4	Net cultivated area (hectares)- <2, 2-4, 4.1-6,>6
5	Net cropped area in Kharif season (hectares)- <2, 2-4, 4.1-6,>6
6	Net cropped area in Rabi season (hectares)- <2, 2-4, 4.1-6,>6
D.	**Characteristics of Agriculture**
1	Traditional Crops/food crops- Yes/No
2	Commercial Crops- Yes/No
3	Horticulture Crops- Yes/No
4	Floriculture- Yes/No
5	Farm Forestry- Yes/No
6	Livestock farming- Yes/No
7	Poultry farming- Yes/No
8	Other Crops- Yes/No
E.	**Availability of Agricultural Infrastructure**
1	Irrigation facilities- Yes/No
2	Fertilizers- Yes/No
3	HYV of seeds- Yes/No
4	Machineries- Yes/No
5	Banking and loan facility- Yes/No
6	Electricity supply- Yes/No
7	Transportation facility- Yes/No
8	Fair price shops- Yes/No
9	Cold storage- Yes/No
10	Market- Yes/No

Data collection

The study is based on primary source of data and has an exploratory design. The primary data were collected through field survey conducted in the months of May-June 2010 with the help of a questionnaire. Before the field work the questionnaire was tested through pilot study and revised accordingly. Out of nine blocks of the study area, one village from each block is selected for intensive study. The selected village was considered the representative of the respective block. In the selection of villages, a purposive random sampling method was applied. In all 942 farm households were interviewed, forming 25% sample of the total household of the selected nine villages. Each 5th household was selected for a cross-sectional survey.

The study was limited to the heads of the households in view of their major role in decision making process and their in-depth knowledge of different aspects of agriculture and its associated problems. Information pertaining to the variables such as physical, cultural, social, economic, demographic characteristics was collected. List of variables are given in annexure 1. Moreover, the collected primary information was supplemented with detailed information (which is not mentioned in questionnaire) procured through general discussion with key informants, such as *Pardhan, Mukhya* and *Farmers' groups*. Farmlands were also visited to observe agricultural practice and to also verify information collected through discussion and questionnaire.

METHODOLOGY

The present study is based on both qualitative as well as quantitative methods. The data collected from the field survey were organized, moderated, tabulated, and analyzed using Statistical Package for the Social Science (SPSS), version 11.5. For the analysis farmers were categorized into five groups on the basis of their size of landholdings (Table 1). Out of the 942 respondents, 332 were very small farmers, 279 categorized as small farmers, 182 medium farmers, 94 large farmers and only 55 belonged to very large farmers' category. Before going into detail of the adoption behaviour of the farmers, the distribution of agricultural land, cropping pattern, availability of infrastructural facilities and farmers' involvement in off-farm activities were analyzed through simple descriptive statistics, implying that it can provide meaningful result and descriptions of variance.

Table 1: Categories of farmers based on size of landholding (hectares)

S.No.	Categories	Size of land holdings	Number of farmers	% age
1	Very small	< 1 hact	332	35.24
2	Small	1-2 hact	279	29.61
3	Medium	2.1-3 hact	182	19.32
4	Large	3.1-4 hact	94	9.97
5	Very Large	>4 hact	55	5.83
	Total		942	100

Source: Based on field survey 2010

For determining the effect of different factors on adoption behaviour of agricultural innovation a multiple regression model was used. Such technique is an appropriate statistical tool to determine the influence of independent variables on dependent variables (Mehta & Kellert 1998, Yila and Thapa 2008). The values of Entropy index computed for measuring level of adoption were taken as dependent variable and different factors affecting adoption of innovation were taken as independent variables. The following econometric model was used to analyze the data.

$$Y = b_0 + b_1X_1 + b_2X_2 + bnXn$$

where, Y is the dependent variable (adoption of innovation), b_0 is the intercept, and b_1, b_2, . . ., bn are the coefficients of the explanatory variables X_1 (size of land holding), X_2 (Economic condition), X_3 (education level), X_4 (tenure security), X_5 (age of the respondents), X_6 (exposure to mass media), X_7 (government extension support services), X_8 (caste of

respondents), X_9 (religion). The model was constructed using the stepwise probability criteria of F to enter -0.050 and probability of F to remove -0.100. The association between farmers' socio-economic conditions and adoption of innovation was tested using the chi-squared test with a significance level of 0.05.

RESULTS

Distribution of agricultural land and the pattern of its use by farmers of different size of landholdings are depicted in Table 2. The table shows that very small and small farmers combinedly have the largest share of net cultivated (65.69%) and gross cultivated areas (78.07%). While the share of medium farmers was recorded 14.73% (net cultivated area) and 7.76% (gross cultivated areas). Large and very large farmers were reported for 19.58% and 14.17% net cultivated area and gross cultivated areas respectively. Very small and small farmers were observed at the top in terms of cropping intensity with the values 182.60% and 178.03% respectively, whereas the low intensity was observed in the case of very large (132.16%) and large farmers (134.68%).

The preference of crops by farmers of different size of land holdings is also shown in Table 2. Food grain crops mainly rice (mean=171.60, SD.118.90) and wheat (mean=161.88, SD.111.88) were mainly cultivated by most of the farmers. Further segregation indicates the dominance of these two crops among very small (rice 96.68%, wheat 90.96%) and small farmers (rice 94.98%, wheat 89.60%) in the region. A small number of farmers of this category also grow potatoes, pulses and oilseeds. While the farmers of medium size of land holdings, in addition to rice and wheat, also cultivate maize, millet and barley (13.17%), oilseeds (35.23%) and sugarcane (8.71%). Next to food grain crops, farmers of large size of landholding grow potatoes (62.5%), pulses (58.33%), oilseeds (40.42%) and sugarcane (30.35%) in Ambedkar Nagar district.

Table 3 shows the involvement of farmers in other agricultural activities. The sample data makes it clear that the large per cent of very small (75.30%) and small farmers (65.59%) were not involved in other agricultural activities except few of them (Table 4). While the medium farmers were observe to carry out dairy farming (15.93%), followed by rent from implements (13.73%) and horticulture (10.43%). Whereas the large and very large farmers were represent a different picture. They were found to be mainly involved in farm forestry and rent from implements. Nearly 47.27% of very large farmers were reported for rent from implements and 16.36% for farm forestry. The respective per cent for large farmers were observed 32.97% and 11.70%.

Table 4 depicts the adoption of agricultural facilities in the study area. Very small farmers have accessibility to only four basic agricultural facilities i.e. HYV of seeds (69.57%), fertilizers (62.94%), pesticides/insecticides (47.35%) and irrigation (40.23%). Small farmers also showed the same trend in the use of agricultural inputs. While the medium farmers in addition to use of irrigation facility (64.94%), fertilizers (77.04%), and insecticides/pesticides (73.03%), have loan (56.04%) and storage facility as well. Large size of landholders enjoyed almost each and every facility. Almost 90% of the very large farmers reported for the use of fertilizer; followed by use of machineries (86.30%), market (85.71%), loan facility (75.59%), and storage facility (69.64%).

Out of the nine independent variables entered step by step into the model, only four variables–size of land holdings, economic condition, farm ownership, and education level significantly influence the adoption behaviour of farmers (Table 5). Both multiple R (99.8%) and R^2 (99.6%) values shows that four independent variables have a positively high level of explanatory power. The model is statistically significant with minimum error of the estimate. The F ratio of explanatory variables in the final model is statistically significant at 0.000 confidence level indicates that the variables included in the model are potential explanatory (Table 6). Of the four Significant variables (Table 7), size of land holdings (X_1) appears to be the most influential, explaining nearly 80% of the total variation, followed by economic condition (X_2), land ownership (X_3) and education level (X_4). The results of the regression analysis show that every unit increase in size of landholding, 0.839 unit increase in adoption is predicted, holding all other variables constant. Similarly, every unit increase in economic conditions and farm ownership will increase chances of adoption. The critical Chi-square is 8.32 at 0.01 level of significance with 4 degree of freedom, which is quite less than the calculated Chi-square 948.74 in case of socio-economic conditions and adoption of innovation

Table 2: Cultivated area, cropping intensity and preference of crops by farmers of different size of land holding in Ambedkar Nagar District

Categories	Land holding		Cropping intensity	Food Grain Crops			Cash Crops				Other Crops		
	Net cultivated area	Gross cultivated area		Rice	Wheat	Millet, Maize & Barley	Cotton	Sugarcane	Tobacco	Soya bean	Potatoes	Oilseeds	Pulses
Very small	38.2	43.35	182.60	321 (96.68)	302 (90.96)	36 (10.84)	-	-	-	-	97 (29.21)	81 (24.39)	63 (18.97)
Small	27.49	34.72	178.03	265 (94.98)	250 (89.60)	37 (13.26)	-	-	-	-	92 (32.97)	74 (26.52)	82 (29.39)
Medium	14.73	7.76	161.08	150 (82.41)	142 (78.02)	32 (17.58)	14 (7.69)	16 (8.79)	10 (5.49)	9 (4.94)	78 (42.85)	67 (36.81)	53 (29.12)
Large	11.29	8.56	134.68	78 (82.97)	73 (77.65)	20 (21.27)	8 (8.51)	17 (18.08)	9 (9.57)	7 (7.44)	41 (43.61)	38 (40.42)	32 (34.04)
Very Large	8.29	5.61	132.16	44 (81.81)	42 (76.36)	14 (25.45)	6 (10.9)	17 (30.90)	7 (12.72)	5 (9.09)	31 (56.36)	27 (49.09)	23 (41.81)
Mean	20.00	20.00	157.71	171.60	161.80	27.80	5.60	10.00	5.20	4.20	67.80	57.40	50.60
S.D.	12.53	17.68	23.60	118.90	111.88	10.26	5.90	9.14	4.87	4.09	30.06	23.59	23.73

Source: Based on Field Survey 2010. Note: Figure in parenthesis is %

Table 3 Involvement of farmers in other agriculture activities

Categories	Dairy Farming	Poultry Farming	Horticulture	Farm forestry	Rent from Implements	None
Very small	23 (9.92)	18 (5.42)	33 (9.93)	8 (2.40)	-	250 (75.30)
Small	32 (11.46)	16 (5.73)	38 (13.62)	10 (3.58)	-	183 (65.59)
Medium	29 (15.93)	8 (4.39)	19 (10.43)	13 (7.14)	25 (13.73)	88 (48.35)
Large	8 (8.51)	-	14 (14.89)	11 (11.70)	31 (32.97)	30 (31.91)
Very Large	4 (7.27)	-	6 (10.90)	9 (16.36)	26 (47.27)	10 (18.18)
Total	96 (10.19)	42 (4.45)	110 (11.67)	51 (5.41)	82 (8.70)	561 (59.55)

Source: Based on field Survey 2010

Table 4: Adoption of innovation facilities by farmers of different size of land holding

Categories	Use of HYV seeds	Use of fertilizers	Use of pesticides/ insecticides	Improved Irrigation facilities	Use of machineries	Institutional credit	Storage facilities	Market accessibility
Very Small	231 (69.57)	209 (62.94)	192 (57.83)	148 (44.57)	32 (9.63)	21 (6.32)	-	12 (3.61)
Small	203 (72.75)	180 (64.51)	168 (60.21)	140 (50.17)	53 (18.99)	21 (7.52)	-	18 (6.45)
Medium	166 (91.20)	133 (73.04)	115 (63.18)	12 (6.59)	68 (37.36)	15 (8.24)	53 (29.12)	65 (35.71)
Large	90 (95.74)	83 (88.29)	75 (79.28)	79 (84.04)	62 (65.95)	38 (40.42)	22 (23.40)	39 (41.48)
Very Large	53 (96.36)	51 (92.72)	47 (85.45)	34 (61.81)	45 (81.81)	37 (67.27)	27 (49.09)	35 (63.63)
Total	743 (78.87)	656 (69.63)	597 (63.37)	413 (43.84)	260 (27.60)	132 (14.01)	102 (10.82)	169 (17.94)

Source: Based on field Survey 2010

Table 5: Summary of the step wise regression model

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1375.105	1	1375.105	56.436	.000
Residual	194.924	8	24.366		
Total	1570.029	9			
2 Regression	1487.742	2	743.871	63.279	.000
Residual	82.288	7	11.755		
Total	1570.029	9			
3 Regression	1553.979	3	517.993	193.641	.000
Residual	16.050	6	2.675		
Total	1570.029	9			
4 Regression	1563.577	4	390.894	302.902	.000
Residual	6.452	5	1.290		
Total	1570.029	9			

[1]Predictors: size of land holding
[2]Predictors: size of land holding, economic condition
[3]Predictors: size of land holding, economic condition, education level
[4]Predictors: farm ownership

Table 6: ANOVA of the regression model

Model	R	R_2	Adjusted R_2	Std. Error of the Estimate
1	.936[1]	.876	.860	4.93615
2	.973[2]	.948	.933	3.42861
3	.995[3]	.990	.985	1.63555
4	.998[4]	.996	.993	1.13600

Table 7: Coefficient of independents variables included in the regression model 4

	Unstandardized Coefficient		Standardized Coefficient (beta)	*t*	Sig.
	B	Standard Error			
Constant	9.855	1.800		5.475	.003
Size of landholding	.839	.037	.944	22.656	.000
Economic condition	.729	.101	.974	7.221	.001
Farm ownership	.555	.115	.729	4.817	.005
Education level	.139	.015	.116	2.727	.041

DISCUSSION

The study highlights predominance of small and marginal size of land holders both in terms of gross cultivated and net cultivated areas in all blocks of Ambedkarnagar district of Uttar Pradesh. The number of small and marginal farmers is on the rise because of increasing demographic pressure on land and subsequently sub-division of land holding on inheritance basis that has led to declining per capita availability of land in the study area. In fact the decreasing size of land holdings is in conformity with the distribution of land holdings of the country as a whole. At all India level, marginal farmers owned only about 16.3% of land (1953-54) that increased to 43.5% in 2002-03. Similarly, they account for nearly 80% of operational holding in 2002-03 as compared to about 61% of 1960-61 (NCEUS 2008). During field survey it was observed that these farmers are seasonal producers, dominated by household economies largely undertake subsistence farming and cultivate each and every bit of their land to support their family. This is one of the reasons of high cropping intensity in small and very small size of land holding in the district (Table 2). The similar results were observed in the study of De and Chattopadhyay (2010). The data indicates that being subsistence farmers, the small and very small farmers emphasized on food grain crops mainly rice and wheat while the farmers of other categories viz. medium, large and very large farmers also cultivate commercial crops (Table 2). Our finding is very much consistent with earlier studies (Summer and Wolf 2000; Ghosh 2010). The study further makes it clear that big and very big size of farmers have greater accessibility to agricultural infrastructure than the small and very small farmers. It may be attributed to small land and asset base of small and very small farmers that leads to inadequate income resulting into poor investment in agriculture facilities. Agriculture today is getting more and more capital intensives that is required for the purchase of improved seed, fertilizer, pesticides, farm implements and farm machinery. It is also due to the apprehension that tiny farms would no longer be economically very viable to modernize farming practices. Moreover, the other income generating sources were also observed to be indirectly determined by size of land holdings to some extent. Being large size of landholders, the big farmers have agricultural implements which they use in their own farm and also to let it to small land holders. Besides, due to better economic conditions they were also observed to improve their income through horticulture and farm forestry while the small and very small farmers mainly depend on poultry and dairy farmings. The reasons were found that small sizes of land holders as agriculturists facing numerous problem such as imperfect markets for inputs/products that lead to smaller value realizations. Lack of credit markets or imperfect credit markets and limited access to suitable extension services cause sub-optimal investment decisions or input applications and suitable decisions regarding cultivation practices and technological know how. Furthermore, they have poor access to public goods such as public irrigation, command area development, electricity grid. The similar results were observed in other studies (Scoones et al 1996; Ashok and Balsubramania 2006).

. . The findings of the regression analysis clearly indicate the influential role of four important variables i.e. size of land holding, economic condition, education level and farm ownership in adoption of agricultural innovations. Other studies were also found influential role of socio-economic factors in their studies (Mbaga-Semgalawe & Folmer 2000; Paudel & Thapa 2004; Bewket, 2007). Size of landholding and economic status are significantly influence the adoption behaviour of farmers and are also closely related with each other. Large size of land holders have better economic condition and vice versa. The larger farms are being financially sounder as compared to smaller farms and for this they have easier access to modern agricultural facilities. They

have much more access to institutional credit as their assets base is stronger than the small farms and this enables them to buy or use modern costly inputs (Ghosh 2010; De and Chattopadhyay 2010). Similarly, education positively associated with higher adoption rates as the educated people are generally less rigid and well expose to reliable sources of farm information that create a state of rationality which in turn predisposes individuals to the adoption of new practices. During study it was observed that farmers cultivating land on lease seem to be somewhat less inclined to adopt new practices than the farmers having their own land that may be due to lack of tenure security.

CONCLUSION

The aforesaid discussion makes it clear that the study area is characterized by small and very small farmers characterized by poor adoption of innovation, less off-farm income generating sources and thus less profitable agricultural practice. Therefore, a strategy for off-farm income accruing activities to afford the cost of technology, thereby increasing the adoption overall and alleviate their socio-economic conditions is a matter of great concern. Diversification of agriculture in favour of more competitive and high-value commodities is reckoned a viable option to overcome deteriorating condition of small and marginal farmers in the study area. There are numerous varieties of vegetables (cabbage, cauliflower, beans, pumpkin, cucumber, carrot, torai, pulwal, muli, sags), pulses (mmong, masur, chana, urad, arhar), fruits (guava, mango, lichi, water melon, jack fruit, aaru) and flowers (roses, marigold), that does not require heavy investment and climatically suited to this region. The other options are dairy farming, poultry farming and fishery. Fisheries appear to be an good option because the study area is well netted by the water bodies. If carried out appropriately, these activities will augment farm income, generate employment, stabilizing income over seasons, ensure food security, reduce poverty, improve productivity of scare resources, protection against crop failure and overall socio-economic development of the society. Several micro-level studies support the above proposition (von Braun 1995; Pingali and Rosegrant 1995; Ramesh Chand 1996; Ryan and Spencer 2001).

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