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Farmers' preferences towards climate smart agriculture practices: An experience in flood vulnerable areas of Assam

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Abstract
The present study was carried out in four climate vulnerable districts of Assam namely Dibrugarh, Sonitpur, Dhubri and Cachar in order to study farmers' preferences towards Climate Smart Agriculture (CSA) practices and factors likely to influence thereon. A purposive and proportionate random sampling method was used for selecting 400 farmers as respondents from four districts. Appropriate statistical methods were used for analysis and interpretation of data. The findings reveal that Stress Tolerant Varieties (STVs), Integrated Nutrient Management (INM) and IPM (Integrated pest Management) were found to be the most preferred CSA practices. The LMR model showed that degree of preference was expressed variation by selected explanatory variables with 51% (R^2=0.51). Dependency ratio of family (X_3)' 'proportion of low land' (X_4), institutional contact (X_6)', 'market accessibility' (X_7) degree of commercialization' (X_{10}) and 'adoption consistency' (X_{13}) recorded to have positive but age (X_1)', annual farm income (X_5) and 'farm experience' (X_8) have negative and significant influence on farmers' degree of preferences. Extension agencies, both public and private should put forward strategic effort to make farmers aware of climate change and its impact on food production, popularizing these technologies need to be taken care of in other similar areas, systematic assessment of other CSA practices available in the research front, different stakeholders (both public and private) in input and output chains should work in convergence mode as a common entity so that farmers get necessary environment for adoption of technologies.

Keywords: Climate change, climate smart agriculture (CSA) practices, degree of preferences

Introduction

Climate change is the major issues for the global communities and serious ecological threat to humanities. During 20th century there was observed of increase of temperature and change of rainfall pattern (Easterling *et al.*, 1999; IPCC, 2001; Jung *et al.*, 2002; Balling and Cerveny, 2003) [8, 12, 14, 4]. Without urgent action, climate impacts could push an additional 100 million people into poverty by 2030 (Zenghelis, 2006) [21]. It is predicted that the overall world agricultural productivity will be declined by 3–16 percent by the 2080 (FAO, 2012a) [9]. In India, huge crop losses were noticed in different states due to wide variation rainfall, temperature and floods. However, the country faces major challenges to increase its food production to feed the ever growing population in the situation where per capita land availability 0.08ha and more than 60% cropped area still rainfed depend on uncertainties of monsoon. In this context, issue is how productivity can be increased while ensuring the sustainability of agriculture and the environment for future generations. Agriculture, which accounts for nearly 14 percent of greenhouse gas emissions, also contributes to climate change (IPCC, 2001) [12]. There is probability to increase of emission while putting effort to increase production and productivity to feed our ever increasing population. Climate Smart Agriculture (CSA) is the only option which can be integrated into the solution to reduce the pace of climate change by sequestering carbon in the soil instead of emitting it into the atmosphere. CSA builds on existing experience and knowledge of sustainable agricultural development (Garnett *et al.*, 2013) [10]. It emphasizes agricultural systems that utilize ecosystem services to support productivity, adaptation and mitigation.

Scaling up and out of these technologies are important for sustainable agriculture growth and development at national and regional level. As an approach for transforming and reorienting agricultural development under the new realities of climate change, the Indian Council of Agricultural Research (ICAR) launched a country wide programme entitled National Initiative on Climate Resilient Agriculture, presently known as National Innovations in Climate

Resilient Agriculture (NICRA) during February 2011 with the funding from the Ministry of Agriculture and Farmers' Welfare, Government of India. In Assam, four districts *viz*., Cachar, Dhubri, Dibrugarh and Sonitpur are such vulnerable districts to flood (Rama Rao *et al*., 2013) [17], where on farm participatory demonstration programmes on various climate smart technologies like stress tolerant varieties of rice, integrated pest management, integrated nutrient management, vermicompost preparation and application and minimum tillage were organized in the NICRA villages of respective district from 2011 to 2013.These technologies are considered as climate smart as they fulfil at least two pillars of climate smart technology.(Bedmar *et al*., 2016; Deng *et al.*, 2016; Saravanan, 2013; Thierfelder *et al*., 2015; FAO, 2012a; CIAT, 2017) [5, 7, 18, 20, 9, 6]. There is a need to examine the choices of farmers towards CSA practices over the other available technologies for sustaining the agricultural production along with mitigating the effect of climate change. Farmers' perception towards attribute of technologies is important because it influences adoption and up scaling of technologies. Thus, understanding and analysing the determinants of farmers' decision to adopt a particular practice among the available choices may provide insights into the factors that enable or constrain adaptation. This will give a picture of adoption of technology even after withdrawal of government assistance. Keeping all the above facts in views, the present study was conducted to assess preference of farmers towards CSA practices and factors influence thereon.

Materials and Methods

The study was carried out in four purposively selected districts of Assam namely Dibrugarh, Sonitpur Dhubri and Cachar where Krishi Vigyan Kendras of respective district implemented NICRA Project since 2011. From each district one village was selected purposively where activities of NICRA project were implemented. The four villages namely Namtemera missing gaon, from Dibrugarh district, Punioni Baghchung from Sonitpur District, Udmari part IV village from Dhubri district and Salchapra-I from Cachar district were selected for the present study. Altogether 400 participating farmers of NICRA Project were selected as sample respondents by following proportionate random sampling methods from each village.

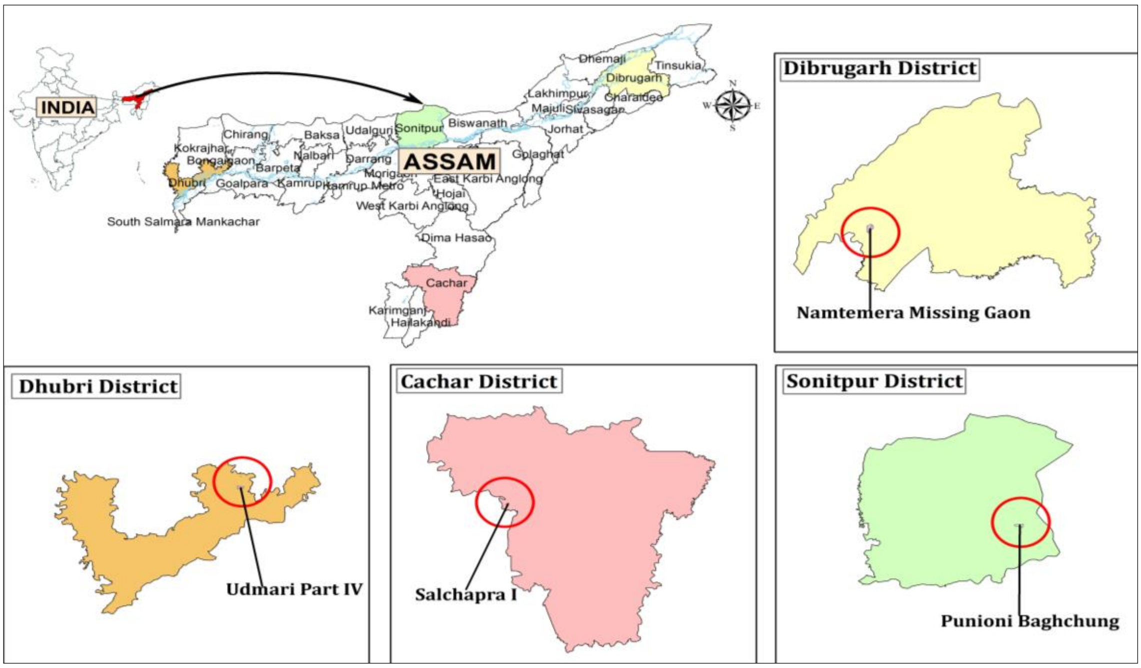

Fig 1: Map of Study areas

After reviewing the relevant literatures, consulting with experts and scientists degree of preference to CSA practices was considered as dependent or predictor variables and 17 independent or explanatory variables *viz*. age, educational experience, size of family, family occupation, dependency ratio of family, operational land holdings, cropping intensity, ratio of farm income to annual family income, training exposure, institutional contact, farm information source's relevancy, market accessibility, farm experience, degree of commercialization, degree of innovativeness, knowledge on CSA practices and adoption consistency were selected in the present study.

Five CSA practices namely 'vermicompost preparation and application', 'integrated nutrient management', 'minimum tillage', 'integrated pest management' and 'stress tolerance variety' which were demonstrated in the sample villages were taken into consideration for assessing degree of preferences of respondents for selected CSA practices. The attributes of climate smart agriculture practices forwarded by Manda *et al*., (2019) [16] were consider for collection of responses in four points continuum as 'not preferred' (0) 'less preferred' (1) 'moderately preferred' (2) 'strongly preferred' (3) against each attributes. Thus, total preference score for respondents were calculated by sum up scores in eight attributes which indicates the degree of preference of respondents. Then, individual preference score was converted to percentage of total score by applying formula.

$$\text{Percentage of preference score} = \frac{\text{Total scores obtained by a respondents}}{\text{Maximum obtainable scores}} \times 100$$

Based on mean weightage score of CSA practices were ranked by using the following formulae-.

$$P_{mwg} = \frac{P_{twg}}{N}$$

Where, P_{mwg} = Mean weightage score for a practice
P_{twg}= Total weightage score for a practices
N= Total number of respondents
$P_{twg} = f_{xi}\,x3 + f_{xi}\,x2 + f_{xi}\,x\,1 + f_{xi}\,x\,0$
f_{xi}= frequency of respondents

The collected data were tabulated and analysed with the help MS-Excel and SPSS programmes. The statistical techniques like frequency, percentage, mean, standard deviation, coefficient of variation, rank, Pearson's correlation coefficient, multiple linear regression analysis, Student's t-test, Fisher's t- ratio, pair wise t-test and Euclidean distance were used in study.

Results and Discussion
Degree of preferences toward CSA practices
Rank preferences of farmers based on mean scores for selected CSA practices
It is observed from Table 1 that the highest mean score was found in case of STVs of rice (15.80) followed by INM (14.71). Thus, STVs of rice and INM were placed in first and second rank, respectively in the rank order of CSA technologies. The IPM was found 3rd rank in terms of mean scores on eight different aspects CSA technologies. The rank 4th and 5th were begged by VC and MT in the rank order of selected CSA technologies.

Table 1: Ranking of CSA practices based on farmers' preference on smartness parameters N=400

Sl. No.	Parameters	VC	INM	MT	IPM	STV
1	Food Production increases	1.63	2.20	1.53	2.26	2.28
2	Income increases	1.67	1.83	1.58	2.07	2.20
3	Consumption increases	1.48	1.46	0.57	1.18	1.82
4	Skill and Knowledge increases	1.77	1.89	1.51	2.18	1.96
5	Access to information easily	1.64	1.59	1.65	1.95	2.01
6	Crop adaptation increases	1.61	1.65	1.71	1.40	2.07
7	Soil protection enhances	2.05	1.99	1.57	1.44	1.43
8	Farm productivity increases	2.00	2.12	1.30	2.00	2.04
Total mean scores		13.83	14.71	11.41	14.46	15.80
	Rank	IV	II	V	III	I

VC= Vermicompost preparation and application, INM=Integrated nutrient management, MT= minimum tillage, IPM=Integrated pest management, STV =stress tolerance variety

The Table 1 and Fig-2 depicts the mean scores based on preference about climate smart parameters. The mean preference score with respect to criteria 'food production increases' was found the highest in case of STV of rice (2.28) followed by IPM (2.26) and INM (2.20). The next mean preference score was found in case of VC (1.68) and MT (1.53).

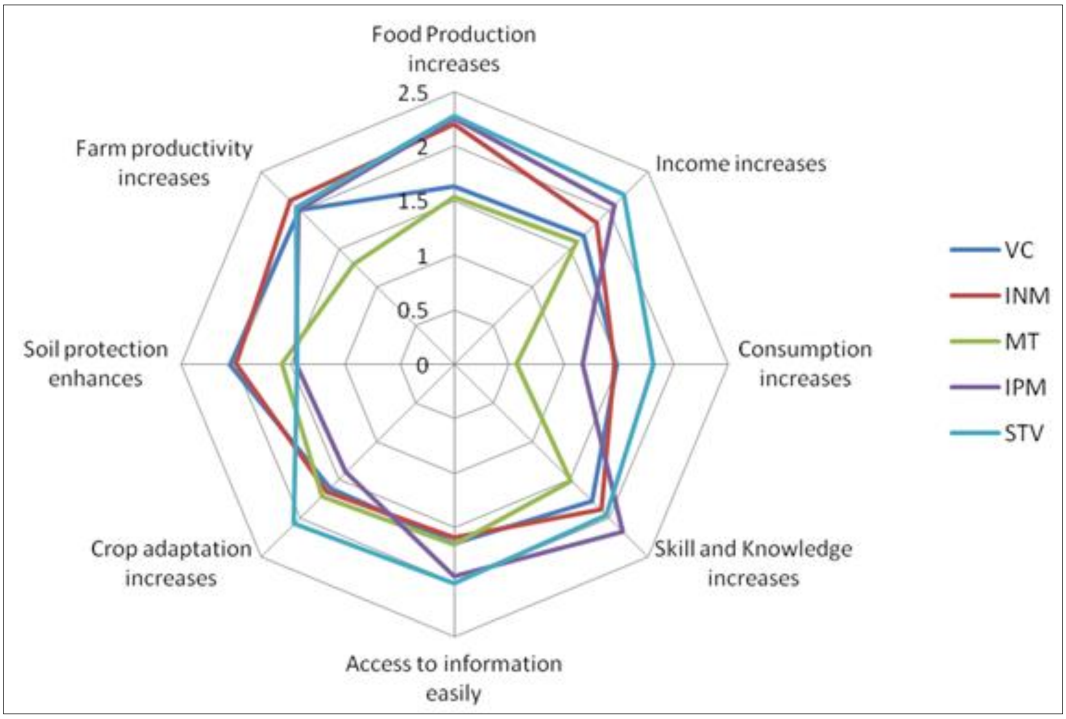

Fig 2: Distribution of CSA practices based on farmer's' preferences on smartness criteria

The similar order of preference of selected CSA practices was observed with respect to the preference criteria 'income increases'. In case of preference criteria 'consumption increases' was found the highest for STV of rice (1.82) followed by VC (1.48), INM (1.46), IPM (1.18) and MT (0.57). In terms preference criteria 'Skill and knowledge increases' the highest mean score was found for IPM (2.18) followed by STV (1.96), INM (1.89), VC (1.77) and MT (1.51). In terms of preference criteria 'access to information easily' the order of preference of selected CSA practices was the first for STVs of rice with mean score of 2.01 followed by IPM practices (1.95), MT (1.65), VC (1.64) and INM practices (1.59). The STVs of rice recorded the highest mean score of 2.07 in terms of preference score 'increases crop adaptation' followed by minimum tillage operation (1.71) and INM practices (1.65). The vermicompost preparation and application and IPM practices were least preferred with mean scores of 1.61 and 1.40, respectively. In terms of preference criteria 'soil protection enhancement' the vermi-compost preparation and application (2.05) was found the most preferred CSA practices followed by INM practices (1.99), MT (1.57), IPM practices (1.44) and STV (1.43) The INM practices (2.12) and STV (2.04) were the first and second preferred CSA practices in terms of farm productivity increases, while vermicompost preparation and application, and IPM practices were third preferred CSA practices with mean score of 2.0. The least preferred CSA practice was MT with mean score 1.33.

Though the five selected CSA practices were ranked into different rank order based on their mean scores, but there was difference among the rank preferences except preference rank of IPM and INM practices. The mean difference between IPM and INM practices in terms of preferences was found statistically non-significant indicating no significant difference between two ranks (Table-2).

Table 2: Pair wise rank difference among the preferences about CSA practices N=400

Sl. No.	Pairs	Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
1	INM - MT	2.780*	5.052	.252	2.283	3.276	11.004	.000
2	INM - VCP	0.880*	4.795	.239	.408	1.351	3.670	.000
3	INM - IPM	0.335^{NS}	4.738	.236	-.800	.130	-1.414	.158
4	INM - FTV	1.102*	6.022	.301	-1.694	-.510	-3.661	.000
5	MT - VCP	1.900*	3.141	.157	-2.208	-1.591	-12.096	.000
6	MT- IPM	3.115*	5.154	.257	-3.621	-2.608	-12.086	.000
7	MT- FTV	3.882*	4.611	.230	-4.335	-3.429	-16.840	.000
8	VCP - IPM	1.215*	4.523	.226	-1.659	-.770	-5.372	.000
9	VCP - FTV	1.982*	4.144	.207	-2.389	-1.575	-9.566	.000
10	IPM - FTV	0.767*	2.991	.149	-1.061	-.473	-5.131	.000

VC= Vermicompost preparation and application, INM=Integrated nutrient management, MT= minimum tillage, IPM=Integrated pest management, STV =stress tolerance variety

Distribution of respondents according to degree of preferences towards selected CSA practices

It is observed from Table 3 that in case of vermicompost preparation and application majority of respondents (64.5 percent) were found in the category of moderate degree of preference followed by less preferred category (27.5 percent). The high degree of preference category was represented by only 8 percent respondents. The mean value of preference (57.6) indicates moderate degree of preferences of farmers towards vermicompost preparation and application. The coefficient of variation with respect to this practice is 0.27 that indicates week variation among the respondents. It may be interpreted that farmers' preference toward vermicompost preparation and application was moderate to low level, as the data set skewed towards the lower level. This may be due to investment required for construction of vermicompost tank, lack of awareness about nutritional content of vermicompost and lack of availability as well as high cost of recommended earthworm species.

Table 3: Distribution of respondents according to their preference to selected climate smart agricultural practices N=400

Sl. No.	CSA practices	Level of preference				Mean	SD	CV
		High	Moderate	Less	Least			
1	VC	32 (8.00)	258 (64.50)	110 (27.50)	0 (0.00)	57.6	15.94	0.27
2	INM	130 (32.50)	138 (34.50)	110 (27.50)	22 (5.50)	61.27	21.23	0.34
3	MT	15 (3.75)	203 (50.75)	148 (37.00)	34 (8.50)	49.68	16.11	0.32
4	IPM	42 (10.50)	330 (82.50)	28 (7.00)	0 (0.00)	62.66	12.47	0.19
5	STV	70 (17.50)	318 (79.50)	12 (3.00)	0 (0.00)	65.81	11.86	0.18
6	Over all	24 (6.00)	284 (71.00)	92 (23.00)	0 (0.00)	59.4	10.38	0.17

Figure in parenthesis indicates percentage

VC= Vermicompost preparation and application, INM=Integrated nutrient management, MT= minimum tillage, IPM=Integrated pest management, STV =stress tolerance variety

Majority of respondents (64.5 percent) moderately preferred the INM practices followed by high preferences for 32.5 percent respondents. But, around 27.5 percent and 5.5 percent respondents were grouped in less preferred and least preferred categories, respectively in terms INM practices. (Table 3) The mean value of INM preference 61.27 percent indicates moderate degree of preference. The moderate degree of variation among the respondents was found in terms of preference of INM practices (SD=21.23 and CV=0.34). But the data set skewed towards lower category indicates preference of farmers about INM practices inclined towards lower category. This may be due to not easily available, complexity especially dose calculation and operation of this technology.

In case of minimum tillage operation majority farmers (50.75 percent) preferred it moderately, followed by less and least preferred by 37.00 percent and 8.50 percent farmers, respectively. Only 3.75 percent farmers preferred minimum tillage highly. The mean value of preference in relation to this variable is 49.68 indicating that average degree of preference of farmers about this practice was less. Low yield, high weed infestation, lack of suitable land and poor preference of crops grown with minimum tillage operation may be the reasons for less preference. The Table-3 and Fig.-2 also reveal that majority of farmers (82.50 percent) had moderate level of preference, followed by high level of preference (10.50 percent) in relation to IPM practices. Only 7 percent farmers had low level of preference about IPM. The mean value (62.66) indicates that average preference of farmers toward IPM was of moderate level with weak variation among the respondents (CV=0.19). It may be interpreted that IPM practices were preferred by farmers, may be due to it increases crop production, easy for operation, enhances food quality and minimizes losses.

In case of Stress Tolerance Varieties of rice majority of respondents (79.5 percent) had moderate degree of preference. The next majority of respondents were found in high degree of preference with 17.50 percent of respondents.

Only 3 percent respondents had less degree of preference towards STV of rice. The mean value (65.81) indicates average degree of preference of farmers were of moderate level with higher end. The coefficient of variation with respect to this practice is 0.17 which indicates weak variation among the respondents. Farmers preferred STV of rice may be due to high adaptability, increase production and income.

The Table 3 also reveals that majority of respondents (71 percent) had moderate degree of preference towards selected CSA practices followed by less degree of preference (23 percent). The high degree of preference towards selected CSA practices was observed for 6 percent respondents. The data set implies that selected CSA practices were preferred, may be due to suitability to their situation, production enhancement and resilient nature of technologies. The findings are corroborate with the findings of Taneja *et al* (2014) [19]; Khatri-Chhetri *et al* (2016) [15]; Joshi and Bauer (2006) [13] and Asrat *et al.* (2010) [3].

Correlation of independent variables with degree of preferences

It is observed from Table 4 that out of 13 independent variables 11 variables were found to have significant relationship with dependent variable i.e. degree of preferences towards CSA practices. The variables 'educational experience' (X_2), dependency ratio of family(X_3), proportion of low land (X_4), annual farm income (X_5) 'institutional contact' (X_6), market accessibility (X_7), degree of commercialization(X_{10}) and 'adoption consistency'(X_{13}) were found significant and positive relationship with degree of preferences. Age (X_1), farm experience'(X_8) and cropping intensity (X_9) were found to be significant but had negative relationship with degree of preferences towards CSA practices.

Farmer's age and their degree of preferences were inverse and moderately correlated (r= - 0.336) indicated that young farmers had high degree of preferences towards CSA practices. Young farmers as compare to middle age and old age farmers are more aware of modern technologies and have a tendency to try new technologies in their farm.

It may be interpreted that farmers with high formal educational experiences had high degree of preferences towards CSA practices. The formal education may change the outlook of farmers towards the approach of agriculture and make them aware about adverse effect of climate change and thus their degree of preference towards CSA practices was high. But r value with respect to educational experience was 0.253 indicates moderate relationship.

Dependency ratio of family had positive and significant relationship with degree of preferences and r=0.217 indicate weak correlation. Farmers with more number of dependent members of family had a tendency to search the best technologies which will give more income to support their dependent and thus it may be a reason for more degree of preferences towards CSA practices.

Proportion of low land had positive and significant relationship with degree of preferences with r value 0.423 indicates moderate degree of correlation. Farmers showed high degree of preferences towards CSA practices who possessed more land area as because of CSA practices had suitability to low land.

Institutional contact (X_6) was found significant and positive relationship with r=0.275 indicates moderate level of relationship with degree of preferences. It indicates that the farmers' contact with more number of institutions had high degree of preferences towards CSA practices. This may be attributed that farmers who have contact with more number of institutions get more information about various aspects of agriculture leads to change their choices towards climate smart technologies.

Market accessibility had positive, significant and moderate (r= 0.338) relationship with degree of preferences. Farmers with high market accessibility either through visit to market by himself or market agent visit to his farm will give more preference to CSA practices.

Farm experiences and cropping intensity had significant, negative and weak relationship with degree of preference towards CSA practices. Farmers with more years of farm experiences compared the any new technologies with their best existing technologies. Because of long attachment and good knowledge about pros and cons of existing technologies farmers were reluctant to prefer new technologies. Again, farmers having high cropping intensity concerned about production rather than environment aspect. This may be reason for farmers with high cropping intensity had low degree of preferences towards CSA practices.

Degree of commercialization had positive correlation with degree of preferences towards CSA practices. The farmers with high level of commercialization has to produce quality product which have high market demand so they preferred CSA practices such as VC, IPM and INM which contribute to produce quality product for consumers.

Adoption consistency of farmers had significant and positive relationship with degree of preference towards CSA practices. The r value 0.325 indicates moderate correlation between adoption consistency and degree of preferences. This indicates farmers who followed CSA practices in more area as well as for more years had high degree of preference.

The findings reported by Khatri-Chhetri *et al.* (2016) [15], Asante *et al.* (2013) [2], Abera *et al.* (2013) [1] and Horna, *et al.* (2007) [11] support the present findings.

Table 4: Relationship of independent variables with degree of preference

Sl. No.	Independent variables	r	t-calculated
1	Age (X_1)	-0.336**	0.000
2	Educational experience (X_2)	0.253**	0.000
3	Dependency ratio of family(X_3)	0.217**	0.000
4	Proportion of low land (X_4)	0.423**	0.000
5	Annual farm income (X_5)	0.105*	0.036
6	Institutional contact (X_6)	0.275**	0.000
7	Market accessibility (X_7)	0.338**	0.000
8	Farm experience (X_8)	-0.160**	0.001
9	Cropping intensity (X_9)	-0.186**	0.000
10	Degree of commercialization(X_{10})	0.196**	0.000
11	Degree of innovative proneness(X_{11})	0.095	0.057
12	Level of knowledge on CSA practices (X_{12})	-0.071	0.154
13	Adoption consistency (X_{13})	0.325**	0.000

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability r = Correlation coefficient, $p<0.05$

Relative contribution of independent variables to degree of preferences towards CSA practices

It is observed form Table 5 that out of total 13 explanatory variables, eight variables contributed significantly to explaining the variation of degree of preference of farmers towards CSA practices. The explanatory variable 'dependency ratio of family (X_3)' 'proportion of low land'

(X_4), institutional contact (X_6)', 'market accessibility' (X_7) degree of commercialization' (X_{10}) and 'adoption consistency' (X_{13}) were found to have positive and significant contribution for explaining the variation of farmers' degree of preference towards CSA practices. On the other hand, 'age (X_1)', annual farm income(X_5) and 'farm experience'(X_8) were found to have negative and significant contribution for expressing the predictive variable degree of preference towards CSA practices. The R^2 value 0.51 (adjustable R^2 = 0.49) indicates that the seven selected explanatory variables expressed 51 percent variation of farmers' degree of preference towards CSA practices.

The findings are in the line of findings reported by Asante *et al*. (2013) [2]; Horna, *et al*. (2007) [11].

Table 5: Regression analysis with predictor variable degree of preferences with selected explanatory variable N=400

Sl. No		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Intercept	12.087	1.312		9.216	.000
2	Age (X_1)	-.080*	.014	-.284	-5.666	.000
3	Educational experience (X_2)	-.059	.039	-.070	-1.508	.132
4	Dependency ratio of family(X_3)	1.259*	.401	.126	3.143	.002
5	Proportion of low land (X_4)	.025*	.006	.244	4.433	.000
6	Annual farm income (X_5)	-.014*	.005	-.119	-2.997	.003
7	Institutional contact (X_6)	1.014*	.128	.395	7.930	.000
8	Market accessibility (X_7)	.193*	.089	.111	2.170	.031
9	Farm experience (X_8)	-.050*	.016	-.223	-3.065	.002
10	Cropping intensity (X_9)	-.001	.003	-.018	-.346	.730
11	Degree of commercialization (X_{10})	.009*	.004	.095	2.423	.016
12	Degree of innovative proneness(X_{11})	.027	.026	.037	1.042	.298
13	Level of knowledge on CSA practices (X_{12})	-.026	.029	-.031	-.875	.382
14	Adoption consistency (X_{13})	.083*	.010	.323	7.970	.000

R^2=0.51 Adjusted R^2= 0.49 F= 30.956* p<0.05

In case of increase in one year of age of farmers the degree of preference towards CSA practices will be decreased by 0.080 times considering the other variables remain constant. Likewise, increase in one unit of dependent member of farmers will be increased by 1.259 times of their degree of preference if other variables remained constant. Increase in one year of farm experience farmers' degree of preferences will be decreased by 0.05 times if other variables remain constant.

In case in unit increase of annual farm income the degree of preferences will decrease by 0.014 times. Similarly, unit increase in market accessibility, degree of commercialization and adoption consistency will increase degree of preference towards CSA practices by 0.193, 0.009 and 0.083 times respectively.

The best predictive model from the selected explanatory variables for the predictor variable degree of preference of farmers is

$$Y= 12.087 - 0.08\ X_1 +1.259X_3 +0.052X_4- 0.014X_5 + 1.014X_6 +0.193X_7 - 0.05X_8 +0.009X_{10} +0.08X_{13} - e$$

Where, X_1 = Age, X_3 = dependency ratio of family, X_4= Proportion of low land X_5 = Annual farm income, X_6 = Institutional contact X_7= Market accessibility X_8 = Farm experience X_{10} = degree of commercialization, X_{13} = adoption consistency'

Conclusion

Farmers' preferences for SCA practices were found to be moderate to high for majority of farmers. Farmers especially preferred STVs, followed by INM and IPM. Popularizing these technologies need to be taken care of in other similar areas by concerned organizations. Moreover, systematic assessment of other CSA practices available in the research front should be made to allow the farmers to choose the best possible technological options suitable to their situation in context of climate change. High degree of preferences was found for fames having high adoption consistency relating to CSA practices. Farmers who have been adopting CSA practices were likely to prefer these CSA practices. Farmers' age, experiences, dependency ratio of family, proportion of low land, institutional contact, annual farm income, market accessibility, degree of commercialization and adoption consistency were found as important determinants which influence on farmers' degree of preference towards CSA practices. Extension agencies both public and private should give due consideration about these factors as well as farmers' preferences while popularising CSA practices among farming communities of vulnerable areas.

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