Adoption Level of Climate Smart Agricultural Technologies in Imphal West District of Manipur

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ABSTRACT

Climate change has long been a raising global concerned issue. Its impact on agriculture and food security has drawn attention to several mitigation and adaptation measures. There are several potential adaptation options to reduce moderate to severe climatic risks in agriculture. Adaptation options that sustainably increase productivity, enhance resilience to climatic stresses, and reduce greenhouse gas emissions are known as climate-smart agricultural (CSA) technologies, practices and services (FAO, 2010). In order to adapt the changing climatic conditions and cope with climate variability, farmers in our country needs to be aware of such technologies, practices and services and adopt the same. This paper assessed the adoption level of Climate Smart Agricultural Technologies in Phayeng village in Imphal West District of Manipur where climate resilient agricultural methods have been introduced under Directorate of Environment, Government of Manipur. A total of 60 farmers have been sampled purposively for the study. Descriptive statistics have been used to analyse farmers' adoption level. Tobit regression has been applied to assess the influence of selected parameters viz. Exposure to Climate Resilient methods, Gender, Age, Education, Farming experience and Land holding size, on the adopted CSA technologies by individual farmers. 100 % of the farmers adopts drainage management system, cover crop methods and follows indigenous technical knowledge in cultivation. 98.33 % of them follow climate housing for livestock and the third most adopted CSA technologies was Zero and Minimum tillage with 70 % of the farmers adopting it. All the factors except education and age were found to have significant effect on adoption level of CSA technologies.

Key words: *Climate Smart Agricultural (CSA) Technologies; Tobit Regression; Phayeng village; Manipur;*

Impact of climate change has been of great concerned globally since decade long. Indian agriculture too is not hideous in this regard. Studies by Aggarwal and Sinha way back in 1993 have predicted the trend that there could be an agricultural decline with climate change, which have been subsequently confirmed by other research evidences from Mall and *Aggarwal (2002).* There are several potential adaptation options to reduce moderate to severe climatic risks in agriculture. Adaptation options that sustainably increase productivity, enhance resilience to climatic stresses, and reduce greenhouse gas emissions are known as climate-smart agricultural (CSA) technologies, practices and services (*FAO, 2010*). Broadly, CSA focuses on developing resilient food production systems that lead to food and income security under progressive climate change and variability (*Vermeulen et al., 2012; Lipper et al., 2014*).

The Climate Change Division of MoEF (Ministry of Environment and Forestry) is India's nodal agency for climate change cooperation and global negotiations. It is also the nodal unit for coordinating the National Action Plan on Climate Change (NAPCC) 2008. The NAPCC has eight major national missions comprising 1) national solar mission, 2) national mission for enhanced energy efficiency, 3) national mission on sustainable habitat, 4) national water mission, 5) national mission for sustaining the Himalayan ecosystem, 6) national mission for a green India, 7) national mission for sustainable agriculture and 8) national mission on strategic knowledge for climate change. Climate Smart

Villages under the NAPCC emphasises the adoption and up-scaling of Climate Smart Agricultural Practices (CSAPs) (*Aryal, J. P., et al, 2015*). *Chhetri, A. K., et al. (2017)* studied farmer's choice of CSA technologies and adoption level in 16 villages in Bhilwara, Jhalawar, Jodhapur and Rajsamand districts of Rajasthan state has found out that most preferred CSA were Crop Insurance, Rain water harvesting, fodder management, weather based crop agro-advisory and contingent crop planning.

In the context of Manipur, Directorate of Environment, Government of Manipur is the State Nodal Agency for Climate Change in the state. The state is an agrarian economy. Rice is the main crop cultivated with 72 % of total cropped area (*GoM, 2017*). Agriculture in the state solely depends on whether parameters. With the changing climatic conditions, impact on agriculture needs to be curved through various climate resilient methods of agriculture and horticulture. In this regard Climate Change Cell of the Directorate of Environment, Government of Manipur has taken up initiatives by introducing climate resilient crop cultivation methods and other strategies to reduce carbon emission in the model village *Phayeng* in Imphal West district of Manipur since 2016. Taking this into account the present study has been conducted in the said village with the following objectives:

i. To enlist the existing climate smart agricultural technologies and assess the adoption level by the farmers
ii. To assess the influence level of selected factors on the adoption of climate smart agricultural technologies

METHODOLOGY

The study has been conducted in Phayeng Village of Imphal West district in Manipur. The village is a Model Carbon Positive Eco-Village. It is located at a distance of 14 km from Imphal City. It has a total population of about 2728 persons. Majority of them are schedule caste with 65% literacy. The village has about 42% working population, of which about 18% as cultivators (*GoM, 2015*). Main occupation of the village is agriculture and animal husbandry. The study is based on primary data. A sample of 60 farmers has been identified based on their knowledge on CSAs with the help of the village chief. A schedule has been prepared based on the pilot survey to meet the objectives stated above.

The north eastern state of Manipur has been chosen purposively for the study to highlight the scenario of CSA technologies in the region. Imphal west district is selected purposively to choose the village where climate resilient methods of cultivation have been introduced since 2016 with the effort from Directorate of Environment, Government of Manipur. Thus *Phayeng* village is taken up purposively for the study. Finally 60 farmers have been selected based on the report of adoption of at least one CSA technologies. Tobit Model: Influence of selected factors viz., on CSAs adoption by farmers measured as a percentage (%) of technologies adopted by individual farmers (*Ibrahima, A. A., et al 2016*). Exposure to Climate Resilient methods, Gender, Age, Education, Farming experience and Land holding size

RESULTS AND DISCUSSION

Table 1 below represents the identified climate smart agricultural technologies and adoption level (%) in *Phayeng* village. There were 11 identified methods *viz*., Rainwater Harvesting, Sprinkler irrigation, Drainage Management, Cover Crops Method, Minimum tillage, Zero tillage, Less harmful pesticides, Climate smart housing for livestock, Improved Crop Varieties, Use of Indigenous Technical knowledge and Agro forestry. Drainage management and cover crop method has long been a practice followed by the farmers. Drainage system is made by digging channels in soil. Covering the crop using dried leaves, straw etc. has long been adopted by the farmers. 100 per cent of the farmers reported adoption of the method in their field. Knowledge of cultivation has been passed on from their forefathers with their modification to adapt to the changing climatic condition thereby making the practices indigenous technical knowledge. 100 per cent of the farmers cultivate their crops based on indigenous technical knowledge. Main livestock reared by the farmers is pig. The piggery house at the individual farmers level is mainly constructed out of wood, bamboo fencing, thatch roofing. This is climate housing style of livestock rearing. 98.33 per cent of the farmers have found to be adopting this method. 26.67 per cent of the farmers follow rainwater harvest via making pipeline from their housing roof collected in water syntax. Improved crop varieties of rice "RCM-9" have been found to be cultivated by 70 per cent of the farmers. Sprinkler irrigation is adopted by 3.33 per cent of the farmers. 1.67 per cent of the farmer adopts agro forestry in their mulberry farm.

Table 1. List of CAS technologies and Farmer's adoption rate (%) in Phayeng Village

Climate resilient methods	Adoption rate (%)
Rainwater Harvesting	26.67
Sprinkler irrigation	3.33
Drainage Management	100.00
Cover Crops Method	100.00
Minimum tillage	58.33
Zero tillage	70.00
Less harmful pesticides	15.00
Climate smart housing for livestock	98.33
Improved Crop Varieties	70.00
Use of Indigenous Technical knowledge	100.00
Agro forestry	1.67

Table 2 presents the result of Tobit regression which depicts the level of influence of selected factors on the adopted CSA technologies. It could be observed that Exposure to Climate Resilient methods, Gender, Farming experience, Education and Land holding size have significant effect on the adoption level of CSA technologies. All the factors mentioned above were found to be significant at 5 per cent level of significance.

Exposure to climate resilient methods: The co-efficient of Exposure to Climate Resilient methods was found to be significant ($P \leq 0.05$) and positively influencing the adoption level. This implies that farmers who have exposure to climate resilient methods of crop cultivation either through training programmes or from friends and relatives have more probability of adopting CAS technologies.

Gender: The co-efficient gender was found to be significant ($P \leq 0.05$) and positively influencing the adoption level. Male have higher level of adoption of CAS technologies. This could be because male takes the lead role in farming activities as their livelihood while females are usually labourers working under the instructions of their husbands and male farm employers.

Age: The co-efficient of age was found to be insignificant ($p>0.05$). This implies that age of the farmers have nothing to do with the adoption level of CSA technologies. It is their farming experience (in years) which is an influencing factor on the level of adoption.

Farming experience: The co-efficient of Farming experience (in years) was found to be significant ($P \leq 0.05$) and positively influencing the adoption level. Those farmers with maximum years of farming experience have higher adoption level of CAS technologies.

Education: The co-efficient of education was found to be insignificant ($p>0.05$). Adoption level was more influence by the farming experience of the farmers and their land holding size not the level of education. This may be because farming is more about their experience in farming practices.

Land holding size: The co-efficient of Land holding size (in acre) was found to be significant ($P \leq 0.05$) and positively influencing the adoption level. Larger the size of land holding more is the cultivation of crops by the farmer which enhances their experience in cultivation. This again induces them to try and adopt varied ways of cultivation to efficiently utilize their resources and increase production.

CONCLUSION

The study has identified 11 CSA technologies adopted by the sampled 60 farmers in *Phayeng* village in Imphal West district of Manipur. Out of the identified CSA technologies, Drainage Management, Cover Crops

Table 2. Tobit regression estimates of selected factors on the level of adoption of CAS technologies

Variables	Coefficient	Std. Error	Z	ρ -value
Constant	1.43	0.194	0.332	0.045
Exposure to Climate Resilient methods	3.34	0.407	7.978	1.49e-015 ***
Gender	0.90	0.293	3.094	0.0020 ***
Age	0.004	0.010	0.3795	0.7043
Farming experience	0.38	0.066	5.821	5.84e-09 ***
Education	0.02	0.021	0.928	0.3534
Land holding size	0.58	0.094	6.107	1.01e-09 ***

*** 5 per cent Level of significance

Method and Use of Indigenous Technical knowledge have 100 per cent adoption by the farmers.

Level of influence of selected factors *viz*., Exposure to Climate Resilient methods, Gender, Age, Education, Farming experience and Land holding size on the adoption of CSA technologies revealed that except for age and education the rest of the factors have positive effect on the level of adoption of identified CSA technologies.

CSA technologies like Sprinkler irrigation and Agro forestry have less per cent of farmers' adoption. This may be because the method is new to them and have misconception of higher cost. Most of the farmers do not like the idea of change from their usual practice of cultivation. So adoption of agro forestry needs proper convincing with examples from success stories.

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