

## Cases of Climate Smart Agricultural Practices in Adopted Villages in North-East India

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### ABSTRACT

The tribal North Eastern Hill (NEH) states of India is highly vulnerable to Climate Change (CC), which will have direct negative consequences on production and productivity, causing serious descent of rural livelihoods and increase food insecurity. The concept of Climate Smart Agricultural Practices (CSAPs) has offered array of solutions to enable farmers mitigate the problems of CC. Case study research design was followed in present investigation to identify the CSAPs in adopted villages of Colleges of Agriculture (CoAs) under CAU, Imphal. Priority Ranking Matrix (PRM) was considered in examining the identified CSAPs. The Integrated Agriculture and Animal Based Farming Systems (IAABFS) with Priority Ranking Score (PRS) of 37; followed by the Agro-horti-animal husbandry IFS (AHAHIFS) with PRS of 21 and the Cultivation of Stress Tolerant Varieties (CSTV) with PRS of 15 were the top prioritized CSAPs at adopted villages under CoA, Imphal, Manipur; CoA, Pasighat, Arunachal Pradesh and CoA, Kyrdemkulai, Meghalaya of CAU, Imphal respectively. The scientific inquiry concluded that CSAPs based on Integrated Agriculture and Animal Based Farming Systems (IAABFS) should be the central to achieve sustainably increasing agricultural productivity & incomes; adapting & building resilience to climate change; and reducing greenhouse gases emission, wherever possible in the NEH states.

**Key words :** NEH; CC; CSAPs; PRM; PRS; IAABFS; AHAHIFS; CSTV;

**A**griculture is extremely vulnerable to CC both in term of physical and social aspect. The manifestations of CC have far-reaching consequences on agricultural sector which will disproportionately affect poor and marginalized groups who depend on agriculture for their livelihoods and have a lower capacity to adapt (*World Bank, 2017*). In particular, rural farmers, whose livelihoods depend on agriculture, are likely to bear the brunt of adverse impacts as resilience is typically low in rural areas as the existing asset base is limited, and services are often insufficient. Indian agriculture is particularly sensitive to CC and variability and it faces the dual challenge of feeding a billion people in a changing climatic and economic scenario. The impacts of CC will be severely felt as agriculture is a sector that plays a key role in overall economic and social well-being of the country.

The NEH states of India is well famous for its rich

heritage and hot biodiversity spots. Farming community constitutes nearly eighty five percent (85%) of population whose livelihood is depending on agriculture. Besides, the tribal NEH states is highly vulnerable to CC which will have direct negative consequences on production and productivity, causing serious descent of rural livelihoods and increase food insecurity. The concept of CSAPs has offered array of solutions to enable farmer mitigate the problems of CC.

The Central Agricultural University, Imphal (CAU, Imphal) at Manipur which was established on 26<sup>th</sup> January, 1993 by an act of Parliament – the Central Agricultural University Act, 1992 (No.40 of 1992) is undergoing a mammoth step in combating negative impacts of CC in agriculture and allied enterprises owned by farmers. The jurisdiction of the university extends to seven NEH states viz., Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim, Nagaland and Tripura,

with headquarters at Imphal in Manipur. Presently, there are 13 vibrant agriculture and allied colleges spread in all the states as mentioned previously.

**METHODOLOGY**

Case study research design was followed in present investigation. Ten farmers each who had an experience of farming for at least 10 years were selected purposively to examine the CSAPs being practices by them from the three adopted villages namely, (1) the Leimaram Maning, Bishnupur District, Manipur under the College of Agriculture (CoA), Imphal; (2) the Ayeng, East-Siang District, Arunachal Pradesh under the CoA, Pasighat; and (3) the Kyrdemkulai, Ri-bhoi District, Meghalaya under CoA, Kyrdemkulai of CAU, Imphal. The scientific inquiry also engaged 50.00% of total strength of final year under-graduate B.Sc. (Ag.) students of the respective colleges to undergo focus-group discussions and observations in identifying the CSAPs. Thereby 13, 8 and 7 students had been randomly selected from the CoA, Imphal; CoA, Pasighat and CoA, Kyrdemkulai, respectively.

Priority Ranking Matrix (PRM) was followed in examining the identified CSAPs. Respondents were asked to specify a weight of '1' for the CSAP which was considered most important and respective highest numerical score for the least important. The Priority Ranking Score (PRS) is the summation of all the weights which had been assigned by the respondents. Hence, the lowest of PRS signifies the most important/highest

prioritized CSAPs. The software SPSS 21 was utilized in analysing the data of the study.

**RESULTS AND DISCUSSION**

Eight CSAPs have been identified in adopted village, Leimaram Maning, Bishnupur District, Manipur under CoA, Iroisemba, CAU, Imphal and out of which, the top five CSAPs have been finally chosen in the study by considering PRS as depicted in Table 1. The identified CSAPs from highest to lowest PRS were: (1) Integrated Agriculture and Animal Based Farming Systems (IAABFS) with Priority Ranking Score (PRS) of 37, (2) Soil Testing & Amelioration of Problem Soil (STAPS) with PRS of 44, (3) Micro Irrigation for High Volume Horticultural Crops (MIHVHC) with PRS of 46, (4) Rain Water Harvesting (RWH) with PRS of 65 and (5) Conservative Cultivation of Kharif and Rabi Crops (CCKRC) with PRS of 66.

Seven CSAPs have been identified in adopted village, Ayeng, East-Siang District, Arunachal Pradesh under College of Agriculture, Pasighat, CAU, Imphal and out of which, the top five CSAPs have been finally chosen in the study by considering PRS as depicted in Table 2. The identified CSAPs from highest to lowest PRS were: (1) Agro-horti-animal husbandry IFS (AHAHIFS) with PRS of 21, (2) Taungya System of Cultivation (TSC) with PRS of 25, (3) Rain and Pond Based Water Conservation (RPBWC) with PRS of 32, (4) Compost Making of Local Biomass (CMLB) with PRS of 35, and (5) Minimum Tillage of Soil (MTS) with PRS of 36.

**Table 1. Priority Ranking Matrix of identified CSAPs in adopted village – Leimaram Maning, Bishnupur District, Manipur under CoA, Iroisemba, CAU, Imphal**

CSAPs	Weight specified by respondents													PRS	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13		
IAABFS	1	2	2	6	1	6	5	1	8	1	1	2	1	37	1
STAPS	6	1	3	4	4	7	1	2	7	2	2	1	4	44	2
MIHVHC	2	4	1	7	2	1	6	3	4	5	5	3	3	46	3
ISRIP	8	3	4	5	8	8	7	5	6	3	4	4	5	70	6.5
CCKRC	3	5	8	2	7	5	3	6	1	8	6	6	6	66	5
RWH	7	8	6	1	3	3	8	4	5	4	3	5	7	65	4
FAASPAE	5	7	5	8	6	4	2	8	2	7	7	8	2	71	8
AFYM	4	6	7	3	5	2	4	7	3	6	8	7	8	70	6.5

(N.B.: R1 – R13 specifies Respondent 1 to Respondent 13)

IAABFS= Integrated Agriculture and Animal Based Farming Systems; STAPS= Soil Testing & Amelioration of Problem Soil; MIHVHC= Micro Irrigation for High Volume Horticultural Crops; ISRIP= Integrated SRI with Pisciculture; CCKRC= Conservative Cultivation of Kharif and Rabi Crops; RWH= Rain Water Harvesting; FAASPAE= Following Agro-Advisory Services Provided by Agricultural Experts; AFYM= Application of FYM; PRS= Priority Ranking Score;

**Table 2. Priority Ranking Matrix of Identified CSAPs in adopted village – Ayeng, East-Siang District, Arunachal Pradesh under CoA, Pasighat, CAU, Imphal**

CSAPs	Weight specified by respondents								PRS	Rank
	R1	R2	R3	R4	R5	R6	R7	R8		
AHAHIFS	1	3	1	4	5	2	1	4	21	I
RPBWC	3	6	2	5	4	4	7	1	32	III
CMLB	7	5	4	1	6	1	6	5	35	IV
MTS	6	1	5	6	7	5	4	2	36	V
TSC	2	2	7	2	1	3	2	6	25	II
FAASPSDA	5	7	3	7	3	7	3	3	38	VII
AITKA	4	4	6	3	2	6	5	7	37	VI

AHAHIFS=Agro-horti-animal husbandry IFS; RPBWC=Rain and Pond Based Water Conservation; CMLB=Compost Making of Local Biomass; MTS= Minimum Tillage of Soil; TSC=Taungya System of Cultivation; FAASPSDA=Following Agro-Advisory Services Provided by State Department of Agriculture; AITKA= Application of ITKs in Agriculture;

**Table 3. Priority Ranking Matrix of identified CSAPs in adopted village – Kyrdemkulai, Ri-bhoi District, Meghalaya under CoA, Kyrdemkulai, CAU, Imphal**

CSAPs	Weight specified by respondents							PRS	Rank
	R1	R2	R3	R4	R5	R6	R7		
CSTV	3	5	1	1	1	2	2	15	1
RSBT	4	1	2	3	3	4	1	18	2
CCHC	1	6	3	5	5	1	3	24	3
RFVCS	5	2	5	2	2	7	4	27	4
RBIFS	2	7	6	7	6	6	6	40	7
AAASPSDA	6	4	7	4	4	3	5	33	5
FFIGAUECC	7	3	4	6	7	5	7	39	6

CSTV=Cultivation of Stress Tolerant Varieties; RSBT=Raised & Sunken Bed Technology; CCHC=Conservative Cultivation in Horticultural Crops; RFVCS: RBIFS=Rain-Fed Vegetable Cropping system; Rice-Beans IFS; AAASPSDA=Access to Agro-Advisory Services Provided by State Department of Agriculture; FFIGAUCC=Formulation of FIGs to Adapt Unwanted Consequences of Climate Change;

*Identification of CSA practices in adopted village – Kyrdemkulai, Ri-bhoi District, Meghalaya under College of Agriculture, Kyrdemkulai, CAU, Imphal :* Seven CSAPs have been identified in adopted village, Leimaram Maning, Bishnupur District, Manipur under CoA, Iroisemba, CAU, Imphal and out of which, the top five CSAPs have been finally chosen in the study by considering PRS as depicted in Table 1 and Figure 1. The identified CSAPs from highest to lowest PRS were: (1) Integrated Agriculture and Animal Based Farming Systems (IAABFS) with Priority Ranking Score (PRS) of 37, (2) Soil Testing & Amelioration of Problem Soil (STAPS) with PRS of 44, (3) Micro Irrigation for High Volume Horticultural Crops (MIHVHC) with PRS of

46, (4) Rain Water Harvesting (RWH) with PRS of 65, and (5) Conservative Cultivation of Kharif and Rabi Crops (CCKRC) with PRS of 66.

Seven CSAPs have been identified in adopted village, Kyrdemkulai, Ri-bhoi District, Meghalaya under CoA, Kyrdemkulai, CAU, Imphal and out of which, the top five CSAPs have been finally chosen in the study by considering PRS as depicted in Table 3 and Figure 3. The identified CSAPs from highest to lowest PRS were: (1) Cultivation of Stress Tolerant Varieties (CSTV) with PRS of 15, (2) Raised & Sunken Bed Technology (RSBT) with PRS of 18, (3) Conservative Cultivation in Horticultural Crops (CCHC) with PRS of 24, (4) Rain-Fed Vegetable Cropping system (RFVCS) with PRS of 27, and (5) Access to Agro-Advisory Services Provided by State Department of Agriculture (AAASPSDA) with PRS of 33.

Similar such research reports had been acquiesced by Han et al. (2016), Othieno et al. (2016), Dympep et al. (2019), Chhetri et al. (2017), Shikukuet al. (2015) and Varadan and Kumar (2014).

## CONCLUSION

The scientific inquiry concluded that CSAPs based on Integrated Agriculture and Animal Based Farming Systems (IAABFS) should be the central to achieve sustainably increasing agricultural productivity & incomes; adapting & building resilience to climate change; and reducing greenhouse gases emission, wherever possible in the NEH states. Enhancing food security while contributing to mitigate climate change and preserving the natural resource base and vital ecosystem services requires the transition to hill agricultural production systems that are more productive, use inputs more efficiently, have less variability and greater stability in their outputs, and are more resilient to risks, shocks and long-term climate variability. More productive and more resilient hill agriculture requires a major shift in the way land, water, soil nutrients and genetic resources are managed to ensure that these resources are used more efficiently. Making this shift requires considerable changes in local and state governance, legislation, policies and financial mechanisms. This transformation will also involve improving producers' access to markets.

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