

# **CLIMATE CHANGE AND AGRICULTURE:**

## **Interface between Cooperatives and Local Government for Climate Smart Agriculture**

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### **Introduction**

It is realized that agricultural production needs to be 'climate-smart'. In other words, agriculture needs to adapt to feed a growing world population in the face of a changing climate, without degrading the natural resource base. FAO (2012:1) writes that "more productive and resilient agriculture will need better management of natural resources, such as land, water, soil, biodiversity ...". Climate-smart agriculture (CSA), which is rooted in sustainable agriculture and rural development objectives, is expected to reduce hunger and improve environmental management. Meinzen-Dick *et al* (2010) note that the response strategies addressing the two main manifestations of climate change, namely, global warming and an increased number of extreme environmental events, are mitigation and adaptation. Adaptation "involves actions that communities and individuals can undertake in response to changing conditions. These approaches include strategies within agriculture such as ... implementing water harvesting or irrigation schemes. Adaptation strategies within agriculture are connected with effective natural resource management (NRM), such as improved land and water management practices" (Ibid: 2). Mitigation strategies "reduce the probability of climate change through sustainable practices that mitigate the increased occurrence, severity, and unpredictability of weather patterns resulting from climate change" (Ibid: 1).

Credit cooperatives in rural areas are likely to be interested in CSA as this may contribute to borrowing, good use of credit and repayment. However, cooperatives cannot directly participate in adaptation activities in rural areas because natural resource management is not their mandate. Grama panchayats can initiate activities towards natural resource management with funds made available through National Rural Employment Guarantee Scheme (NREGS). In the interest of climate smart agriculture leading to sustainable rural development, there is need for an interface between Cooperatives and grama panchayats. On the other hand, mitigation strategies involve reducing greenhouse gas effects with the help of

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good agricultural practices. Here, cooperatives can play a direct role as well as indirect role by having interface with other local organisations.

It is in this context that the following questions arise: Do households, grama panchayats and cooperatives perceive that they are witnessing climate change in their villages? If yes, what changes do they see? What adaptation measures have been taken up by the local government and farmers? What mitigation measures are taken up by farmers? Do local organisations support farmers in this? Is there any interface between cooperatives and other local organizations including grama panchayats in the climate smart agriculture?

It is proposed to address these questions in this explorative study with the help of primary data collected from nine villages from four taluks in Bellary district in Karnataka. Located in the north Karnataka region, this district is characterised by irrigated and non-irrigated agriculture. With the help of assured canal irrigation provided by the Thungabhadra dam, the farmers from the three taluks of Hospet, Bellary and Siruguppa crops such as paddy, cotton, chillies and so on. On the other hand, farmers from villages not endowed with canal irrigation depend on uncertain rainfall and rainfed agriculture for their sustenance. The nine villages selected represent these differences in irrigation endowment. The villages of Hosahalli H, Nadavi and Siddamanahalli are irrigated, while Siddaramapura, Meenahalli and Susheelanagar are non-irrigated villages. The three villages of Palaiahakote, Poojarahalli and Bhujanganagara are semi-irrigated villages.

We have collected information covering size and composition of the village, the extent of irrigated area, cropping pattern and other details from sample villages with the help of checklist. We have conducted a focus group discussion (FGD) with farmers and agricultural labourers in each of the villages with the help of a checklist. The information collected from FGD included perceptions on climate change, role of institutions especially the grama panchayat in addressing the challenges posed by the climate change and how they are tackling the issues relating to climate change. In addition, interviews were also conducted with the officials of credit cooperatives catering to the sample villages.

### **Profile of the sample villages**

The profile of the sample villages shows that there is considerable variation across the village types in terms of caste, irrigation, cropping pattern and occupational distribution of households. We will present the profile of the sample villages below.

In the non-irrigated villages, nearly 61 per cent of the households belonged to SC community. The other important caste group is ST. The dominant caste (Lingayat and Vokkaliga) households accounted for just about 10 per cent of the households. In the semi-irrigated villages, the proportion of SC households is less than 10 per cent. On the other hand, the dominant castes accounted for nearly 45 per cent of the total households. In the irrigated villages, the proportion of households belonging SC and dominant castes were 24.1 and 21 per cent, respectively. In these villages, the ST households was the numerically dominant community.

As far as the extent of irrigation across the sample villages is concerned, the proportion of the irrigated area to total was the lowest in the non-irrigated villages and the highest in the irrigated villages. The proportion of irrigated area to the total area was just 3 per cent in non-irrigated villages, 30 per cent in semi-irrigated villages and 82 per cent in irrigated villages. The quality of irrigation also differed across the village types. Wells were predominant source of irrigation in the non-irrigated and semi-irrigated villages, whereas canals<sup>2</sup> accounted for nearly 93 per cent of the irrigated area in the irrigated villages.

As can be expected, the cropping pattern also varied by the village types. At broader level, food crops accounted for 77 to 90 per cent of the total cropped area in these villages. However, the composition of food crops differed across sample villages. In the non-irrigated villages, Jowar and pulses accounted for considerable area under food crops; In addition, maize was grown as rainfed crop. In semi-irrigated villages also jowar and korra accounted for considerable area under food crops. However, maize is grown with the help of well irrigation. In addition, groundnut and onion crops accounted for over 20 per cent of the cropped area. In the irrigated villages, paddy accounted for nearly 60 per cent of the total cropped area, chillies for 18 per cent of the area, cotton for 7 per cent of the total area; all these crops together with maize are grown under assured irrigation provided by canals.

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<sup>2</sup> In one of the villages, all the households lift water from the nearby canal through pipes.

Wage labour in agriculture and non-agriculture was the principal occupation for 77 per cent of the total households in non-irrigated villages, while it is cultivation for 22 per cent of the households. In both semi-irrigated and irrigated villages, about half of the households depended on wage labour. But, cultivation is the principal occupation for 41 to 45 per cent of the households in these two types of villages. In addition, occupational diversification into salaried employment and non-farm activities could be seen in these villages.

Thus, non-irrigated villages consist of households belonging to SC community: most of the households depend on wage labour. With much of the cultivated area depending on rainfall, households from non-irrigated villages grow food grains. In the irrigated villages, much of the cultivated area received assured irrigation through canals. They grow high value crops of paddy, chillies, sugar cane, cotton and so on. The semi-irrigated villages fall in between the two types of villages.

### **Perceptions on climate change**

Key informants from the sample villages excepting those from irrigated villages perceive that there has been climate change. The key informants from non-irrigated and semi-irrigated villages strongly felt that climate change has been occurring in their villages in the last couple of decades. The perception was based on three criteria – (a) change in the weather; (b) timing and quantum of rainfall; and (c) agricultural yields. The private traders and other players seem to have exploited the situation. As an alternative strategy for livelihood, mining sample households which have boomed in some of these villages.

The key informants from non-irrigated villages complained that climate change in the recent years has affected the agriculture in their villages. The responses from these villages are provided below.

- From one village, it was stated that *“about 20 years ago, the weather was not like this; rainfall used to be at the right time and in abundance. Because of this, tanks used to be full and farmers used to have the work throughout the year...now with insufficient rainfall, farming has become uncertain, and hence, people are forced to depend on mining work as wage labourers”*.

- In the second village, it was informed that *"...in the recent years there is a scarcity of rainfall. As a result, farms ponds or tanks are not getting filled...so private companies started the mining work which resulted in cutting of several trees...because of the mining work, dust settles on crops grown in the field and this affects the yields "*.
- In another village, it was reported that *"...because of lack of rainfall and change in the atmosphere, germination of seeds and crop yields are getting affected...hence the agricultural field is left uncultivated for many years"*.

The key informants from the three semi-irrigated villages strongly agreed that there has been climate change and rainfall pattern. In one of the villages, it was stated that *"with less rainfall and booming mining activity, commercial crops cannot be grown; only a few crops can be grown that too with low yields... 1000s of lorries plying everyday for mining work also affect the atmosphere. Added to that, the trees in the hills are also removed...there is water scarcity...all these are affecting the animals and human beings"*. The response from another village was, *"In earlier years, rainfall was better, now with uncertain and low rainfall...the water table has gone down...as a result villagers are migrating to coffee-growing districts in search of work"*. In the third village, key informants responded that *"earlier cultivation was dependent on the sufficient water in open wells and on the first-rain (**mungaru male**), then we used to grow several oil seeds and commercial crops, now there is no water in open wells and unpredictable rainfall makes it difficult"*.

Interestingly, the climate change that has been experienced by the semi and non irrigated villages is not being experienced in irrigated villages. Key information from these villages categorically stated that the cultivation is not affected as the villagers draw water from the nearby Tungabhadra dam and several tanks in the villages. The key informants from these villages, in fact, feel that things are now better as compared to the past three decades due to availability of better technology.

### **Adaptation strategies**

Farmers can undertake the adaptation measures at two levels - individual or farm level and collective or village level. The individual/ farm level meaning include changes in the cultivation practices, cropping pattern, choice of seeds and farm ponds, while the collective or village level strategies includes construction and maintenance of tanks, and percolation

tanks. On the other hand, mitigation strategies include plantation of trees and agro-forestry. Adaptation measures taken in the sample villages are discussed in this section, while mitigation strategies will be discussed in the next section

### **Cultivation practices**

In one of the non-irrigated villages, key informants reported that they have not made any changes in the cultivation practices. When asked for the reason, they posed the question back to us: “*when there is no rainfall, how can we cultivate?*” In another village, it was stated that “*About five years ago, a few measures were undertaken by constructing small bunds to arrest the rain water flow in the farm land and to ensure sufficient moisture for crop cultivation; then the sowing is done opposite direction of water flow...however no changes are done recently*”. In this village, although villagers keep changing cultivation practices the cultivation is still a problem.

The response from one of the semi-irrigated villages was: “*cultivation practices continue to be the same as was before...as there is mine work, people depending on cultivation has come down.*” The Key informants from another village reported that they change sowing pattern each year. In one year, the sowing is done from east-to-west and another year it is done from north-to-south. Apparently, KAWAD<sup>3</sup> had provided awareness to villagers on how to use the rain water effectively. KAWAD suggested for construction of small bunds in the field to arrest the rain water and thereby preventing the flow of rain water. Key informants felt that this practice was beneficial.

Information provided in three irrigated villages was more or less the same. It was informed that the cultivation practices in these villages did not change over a period of time. In earlier years, there was no need for any pump set, as water was available all the time. However, in the recent years, pump sets have been installed by the farmers to draw water into their fields.

### **Cropping Pattern**

In one of the non-irrigated villages, it was reported that there have been changes in last couple of decades. Due to the climate change and shortage of rain fall, the villagers have shifted from the more water consuming crops to less water consuming crops. In addition,

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<sup>3</sup> This watershed development programme, which aimed to improve the agricultural productivity, implemented by the Government of Karnataka with the funding support of Dfid about 10 years ago.

there has been shift from multi-crops to a single-crop. For instance, in one village it was stated that *“we used to grow many crops such as jowar, sajje, maize, cotton, millets, banana, vegetables etc., but now we only grow chickpea (channa) due to a change in the timing of rainfall and less rainfall”*. In another village, it was reported that dust from mining activity retards the growth of crops.

Key informants from two semi-irrigated villages stated that there has been no change in the cropping pattern. In another village, it was informed that they used to grow ragi, jowar, bajra, *navane*, but now only sunflower and maize as they perceive that these crops consume less water. Another reason could be that these are cash crops.

Cropping pattern in irrigated villages has not been changed. The crops such as paddy, groundnut, cotton, chillies, etc., that were grown some years ago are still grown. Many grow paddy crop because of assured irrigation through canals.

### **Choice of Seeds**

Choice of seeds continues to be the same as was in the past. Whatever seeds that were available in the market are used in these non-irrigated villages. In one village, key informants reported that *“there is no change in the seeds, but there is change in fertilizer type”*. Apparently, earlier organic manure was used and the villagers did not face any problem, but now with the application of chemical fertilizers the land is losing the productivity.

The discussions with the key informants from the three semi-irrigated villages revealed that they continue to sow the same type of seeds. In some places, they keep the seeds grown in the earlier year and use the same seeds in the next year. In other places, they buy the seeds that are sold in the local market. Some farmers prefer seeds sold by the standard companies as there are several companies in the market selling different types of seeds. Some of them sell poor quality seeds. *“Villagers, by listening to some people bought seeds from bad companies and burnt their fingers when they did not get good yields”*, a key informant from one village said. In another village, it was told that now they get only hybrid seeds which can be grown in short span of time.

In one irrigated village, key informants reported that they buy a new hybrid seed, which helps in good growing of crops. There was no change in the choice of seeds in the second village. In the third village, there is small change in the variety of paddy sown during different seasons.

### **Farm Ponds**

The key informants from non-irrigated villages reported that no farm ponds are constructed in two villages. In one village, it was told that *“our tank used to get filled-up about 20 years ago, but now not even a single drop in this tank...nobody bothers to construct farm ponds”*. Similarly, key informants from second village reported that *“neither farm ponds were constructed nor discussion for construction has taken place”*. In another village, it was told that 5-6 farm ponds were constructed under MGNREGS. However, there is no water in these ponds due to lack of rainfall.

The key informants from semi-irrigated villages expressed their displeasure by stating that the *“...farm ponds are not constructed, all the funds are eaten by grama panchayat members only...people did not benefit even by a single rupee from the grama panchayat”*. In other village, it was complained that *“all the facilities are provided to the people residing in GP headquarter village, not to our village...nobody listens to us”*. In this village, KAWAD had selected most needy farmers and constructed 20 farm ponds in their field. These ponds get water only when there is rain, otherwise no water.

Farm ponds were not constructed in irrigated villages, as the farmers did not feel the need for the same. In order to improve the irrigation facility, the work as widening of the channel was undertaken in one village. In another village, it was stated that there is no need for farm ponds as they have got pump sets through which water is lifted directly from the river stream. In the third village, key informants reported that farm ponds were not constructed; but only a tank was constructed. However, not much water in this tank as it requires desiltation.

### **Construction (or maintenance) of percolation tanks**

In two of the non-irrigated villages, key informants informed that no activities relating to construction of new tanks or maintenance of existing tanks were undertaken. In fact, key informants were not fully aware of the percolation tanks and benefits from them. Key informants from the third village told that about a few years ago a tank was constructed and



maintained well by removing silt from time to time until five years ago. This tank was very beneficial to the farmers. However, in the last five years, tank does not have water as there is no rainfall.

The work on desiltation of tank was undertaken in one of the semi-irrigated villages. As a result, water gets stored in this tank for at least 3 months, which is helpful to agriculture and livestock animals. In order to increase the water table, percolation tanks were constructed at some places. Desiltation of tank was not done in the second village. Here, the key informants are of the opinion that water problem can be solved if silt is removed from the tank. However, local government authorities pay no heed. When enquired about percolation tanks, key informants countered “*when silt is not removed from the existing tanks, how will they construct new percolation tanks?*” No new percolation tanks are constructed. Authorities had only promised to desilt an existing tank. However, this has not been done.

It appears that the need for percolation tanks was not found in the irrigated villages. Key informants informed that there is no need for percolation tanks as their village falls under the irrigated area and this type of tanks are required in non-irrigated area. Apparently, there are two tanks in the village; of them, desiltation has been done for only one tank and this tank caters to the drinking water need for the entire village. The second village had three irrigation tanks about 15 years ago. However, these tanks got closed for not removing silt regularly. Similarly, the key informants reported that neither the construction nor the maintenance of exiting tanks has taken place.

### **Mitigation measures**

In one of non-irrigated villages, saplings were planted on both sides of road. However, due to poor maintenance, the plants have been destroyed. In another village, a local mining company had taken initiative to plant several saplings in order to maintain better environment. Accordingly, several saplings were planted. However, the growth of these plants is getting affected because of the dust and on account of 1000s of lorries plying every day.

In one of the semi-irrigated villages, Plantation of trees was done on the sides of road. However, they have gone bad because of low rain fall and non-involvement of people. At some places, trees were cut for brick making (brick-burning). In another village, a few years

ago, afforestation was done on the road sides, near grama panchayat office and school. The plants near grama panchayat and school premises are fine. However, in other places it has become bad due to neglect.

Key informants from one of the irrigated villages reported that saplings are planted on the sides of road. In other village, afforestation work was undertaken under MGNREGS during summer time. However, the saplings dried up due to lack of water. The villagers complained that had this work undertaken during rainy season, the saplings would have grown to some level! In the Third village, saplings were planted on both sides of the road. However, they have gone bad.

In the ensuing section, insights emerging from discussions with the Secretaries of the Primary Agricultural Cooperative Societies (PACS) catering to our sample villages are provided. Some of the questions that can be raised in this context are as follows. Do PACS perceive that there is climate change in the sample villages? If yes, how do they perceive? What measures have been undertaken by them as well as local grama panchayats to address the climate change? Has there been any interface between cooperative societies and grama panchayats in addressing the problem of climate change? An attempt is made to provide answers to these questions.

### **Witnessing climate change: Perceptions by Secretaries of PACS**

The officials of PACS from non-irrigated villages perceive that there has been climate change in the last few years. It is seen in terms of lack of rainfall, excess heat, despite cloudy weather not resulting in rainfall, etc. Farmers and farm animals are suffering due to lack of rain. The standing crops are getting dried up, farm animals do not have water to drink, water is depleted in the bore wells, and plants and trees are also getting dried up due to excess heat and lack of moisture.

According to the officials of PACS from semi-irrigated villages, the climate change was experienced in their villages as well. It was told that about 10 years ago, quantum of rainfall received in these villages was as much as rain received in coastal or malnad regions. However, climate has changed drastically in the last one decade. Irregular rainfall, variation in the weather and raising temperature have caused difficulty to farmers and farm animals. Variation in the atmosphere also caused health hazards among the villagers. It was told that

because of these problems, people are migrating to nearby towns or urban areas in search of livelihood.

The discussion with PACS catering to the irrigated villages revealed that the villagers belonging to this category have also experienced the climate change. However, the impact of climate change is relatively lesser because these villages are irrigated and have access to water bodies. The type of issues mentioned relating to climate change was slightly different than other category of villages. There has been variation in the rainfall. During summer season relatively lesser rain, while in rainy season it is better. The Tungabhadra dam gets filled up and water over flows into the villages. As a result, the water gets stagnated at different places, thus, causing the problem of mosquitoes. The use of chemical fertiliser is also contribution to mosquitoes breeding.

#### **Measures taken by PACS and Grama Panchayats**

When asked about the measures taken by the cooperative societies to address the climate change problem, the Secretaries of PACS catering to non-irrigated villages stated that they only provided credit facility to the farmers. This loan amounts ranging from Rs.20,000 to Rs.32,000 were given without any interest rate. The loans thus given will be renewed each year. Whenever there is a drought, the government waives this loan amount.

It was told that apart from crop loans, loans to purchase of seeds and fertilizers, they have not undertaken any other activities to address the climate change problem. However, they feel that the local grama panchayats have undertaken a few measures towards this. Farmers were given free saplings, construction of farm ponds and bunds. They feel that utilising the MGNREGS funds on soil and water conservation and afforestation will have beneficial impact on agriculture.

The PACS from semi-irrigated have extended various loan facilities to farmers such as loans for crop production, dairying, purchase of tractor, business development plan and so on. Other than credit facility, no specific measures were undertaken.

However, they were of the opinion that grama panchayats have undertaken measures such as construction of check dams, construction of bunds in the field and afforestation. They also

feel that spending MGNREGS funds on activities such as soil and water conservation and afforestation will have a beneficial impact on agriculture.

PACS catering to irrigated villages have basically provided the credit facility to the farmers with zero per cent interest rate for farming activities. In addition, following activities were undertaken.

- Provided loans for digging of borewells and installation of pump sets at less interest rate.
- Provided loans for purchase of tractors.
- Provided loans to women self-help groups.
- Renting out the tractors, owned by these PACS, to farmers
- Farmers were given saplings.
- A meeting was facilitated between the companies and the farmers to avail seeds, pesticides, chemical fertilizers at reasonable rates.
- Farmers were informed to use less of chemical fertilizers.

It was informed by the officials of PACS that the sample grama panchayats have also undertaken the measures to reduce the adverse impact of climate change. Some of them are:

- Free saplings to farmers.
- Removal of weeds in the drains during rainy season.
- Establishment of water purification centres.
- Construction of check dam in the low lying area.
- Construction of bunds in the agricultural field.
- Spraying of mosquito repellent during rainy season.

It was told that these Grama Panchayats make use of funds under MGNREGS for soil and water conservation and afforestation work in the villages.

### **Interface between PACS and Grama Panchayats**

Officials from non-irrigated villages informed that there is no interface between PACS and Grama Panchayats relating to climate change. However, they feel that there is a need for an interface. They suggested that the grama panchayats should provide awareness to farmers on the choice of crops for better cultivation, adverse effects of chemical fertilizers, usage of limited water and stopping the cutting of trees.

In semi-irrigated villages also there is no interface between these two organisations, though they see the merit in the interface. When asked them about some of the ways in which

cooperatives and grama panchayats can address the climate change, the following are suggested.

- Grama panchayat and cooperatives should come together to discuss the problems of farmers and take appropriate measures.
- Activities such as construction of farm ponds and bunds have to be taken up.
- More number of plants/ saplings has to be planted.
- Construction of soak pit next to each borewell is needed to recharge them.
- There is need to stop the mining activities, as it is adversely affecting the climate.

Even in the irrigated villages, there is no interface between these two organisations. The officials of PACS feel that there is need to come together to address the problem of climate change. When asked in what ways this can be done, the following were the responses.

- More importance to afforestation and water conservation.
- Awareness to farmers to reduce the use of chemical fertilizers.
- Awareness to farmers on type of crops to be grown during different seasons.
- Farmers should be given good quality of seeds.
- Awareness to farmers on importance of having farm ponds.

## **Conclusions**

In this paper, an attempt is made to document the perceptions of households and local organizations on climate change and measures (adaptation and mitigation) adopted by them to make agricultural production climate smart.

The data for the paper were collected from key informants from three types of villages (non-irrigated, semi-irrigated and irrigated) and officials of credit cooperatives catering to these village with the help of checklist in Bellary district of Karnataka state.

The profile of sample villages shows that there is considerable variation across the village types. As can be expected, households from non-irrigated and semi-irrigated villages depend primarily on rainfall and grow food grains. Most of the households in the non-irrigated villages belonged to SC community and depended on wage labour for their sustenance. In contrast, households from the irrigated villages receive irrigation through assured source of canals and cultivated high value crops such as paddy. The profile of the selected villages thus shows that households from the non-irrigated village depend on rainfed cultivation and hence requires support towards climate smart agriculture.

Key informants from sample villages perceive that there has been climate change, which gets reflected in terms of changes in (i) weather, (ii) timing and quantum of rainfall, and (iii) agricultural productivity. The information collected from key informants shows that, in the past, timely and copious rainfall was instrumental for having water in the local tanks/ponds, cultivation of multiple crops leading to food security and having employment all through the year. In recent years, however the deficient and untimely rainfall is contributing to the problem of local tanks/ponds not getting filled in and not able to follow the cropping pattern that was being followed earlier. With employment and income from farming becoming uncertain, people are working as wage labourers in non-agricultural (mainly in mining or migrate to other areas).

In this context it becomes important to understand the role played by the grama panchayats in making the agricultural climate smart. It may be noted that grama panchayats have been having access to funds from NREGS, which has been implemented in the state for the last 9 years. As is well known, NREGS funds will have to be spent on activities such as soil and water conservation through land development works and construction of local tanks, encouraging farmers to construct farm ponds, afforestation activities, etc. All these activities contribute to making agriculture climate smart.

Key informants from the sample villages however informed that grama panchayats did not even discuss about the construction of farm ponds/tanks. They highlighted that the poor governance in the decentralized government has contributed to non provision of service relating to climate smart agriculture. It was also highlighted that there was inequality in the provision of facilities between villages where grama panchayat headquarters were located and interior villages. In so far as the work relating to plantation of trees is concerned key informants from all the villages have reported that mitigation measure of planting tree saplings was undertaken. However, due to implementation flaws such as plantation in the non rainy season, lacks of fencing and poor maintenance have resulted in the failure of afforestation programme.

Local credit cooperatives have also observed that there is climate change, and that farmers are suffering on account of this. The activities undertaken by them are however related to routine lending to farm and off-farm activities. They did acknowledge that the local government has considerable role in the initiation of measure to promote climate smart

agriculture. An important positive aspect is that the officials of local credit cooperatives realize the need for an interface between the local government and cooperatives.

Importantly, climate change has been noticed in all the villages and villagers are also experiencing the adverse impact of the climate change. In some of the villages, adaptation and mitigation measures were undertaken. However, these measures were not implemented effectively mainly because of lack of awareness on the associated value of this. There is therefore an urgent need to provide awareness on these activities which will have long term effect on the climate smart agriculture.

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