



# Adaptation Strategies of Women Rice Farmers in Karnataka: A Critical Perspective on Climate Change

Sampreetha. H. N<sup>a++\*</sup>, K. Ravi Shankar<sup>b#</sup>, B. Savitha<sup>c†</sup>,  
Anand. K.R<sup>d++</sup> and Chinni Venkata Sai Bharath<sup>a++</sup>

<sup>a</sup> Department of Agricultural Extension, ICAR- National Dairy Research Institute, India.

<sup>b</sup> Department of Agricultural Extension, ICAR- CRIDA, India.

<sup>c</sup> Department of Agricultural Extension, PJTSAU, India.

<sup>d</sup> Department of Agricultural Extension, ICAR- Indian Agricultural Research Institute, India.

## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

Rice is a staple crop in India. However, climate change has a considerable impact on rice production at many growth phases. On the other side, agricultural practices also contribute to about 30 percent of overall greenhouse gas emissions. 18 percent of the total methane is emitted from rice fields. Hence agriculture is both a victim of and a contributor to climate change. Women, especially in poverty, bear a disproportionate burden from climate change consequences. Further,

<sup>++</sup> Ph.D. Scholar;

<sup>#</sup> Principal Scientist;

<sup>†</sup> Associate Professor;

\*Corresponding author: E-mail: [sampreetha9804@gmail.com](mailto:sampreetha9804@gmail.com);

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they are major contributors in rice farming. Therefore, an attempt was made to study the adaptation of women rice farmers to climate change through an ex-post facto research design. The study encompassed 120 respondents from two districts in Karnataka. The findings indicated that majority of women farmers exhibited a medium level of adaptation to climate change (53.33%) followed by low (30.00%) and high (16.67%) adaptation. Understanding the profile characteristics of farmers and identifying factors influencing their adaptation emerged as key challenges in this study. Conducting more result demonstrations for showing the worth of improved varieties and technologies to women farmers and increasing the number of female extension officers to ensure higher participation by the women farmers can enhance their adaptation to climate change.

*Keywords: Adaptation; climate change; Karnataka; preparedness; rice crop; women farmers.*

## 1. INTRODUCTION

Agriculture and climate change are correlated, as climate change is the grass root cause for the biotic and abiotic stresses, which have adverse effects on the agriculture of a particular region. Climate change is projected to increase cereal prices by 29 per cent by 2050. Water scarcity is going to affect 40 per cent of the population. For every 1°C rise in temperature, 500 million extra people will face a 20 per cent reduction in renewable water resources. Plant pest and diseases are also spreading faster with climate change [1].

Gender, being a social construct, significantly influences the roles, responsibilities, and access to resources and opportunities within a society. This construct interacts intricately with climate change, resulting in distinct experiences, challenges, and responses for both women and men. Women, particularly in developing countries, often bear the brunt of climate change impacts, yet they possess valuable knowledge and capacities to contribute to climate adaptation and mitigation efforts. Therefore, understanding the complex interactions between climate change and gender becomes imperative to develop effective and fair climate policies and initiatives.

Rice is the most important staple crop in India and the contribution of women farmers to rice cultivation is remarkable, as they actively engage in both rice production and processing practices. Majority of tasks related to rice cultivation, such as nursery management, weed control, transplanting, irrigation, and harvesting are performed by women farmers. They also play a significant role in making farm management decisions, including input selection, labor hiring, and pest and weed management in rice crops. Recognizing the importance of a gender perspective in all aspects of climate change becomes essential. Technological advancements

addressing climate change should consider women's specific priorities and needs, drawing upon their valuable knowledge, expertise, and traditional practices. By involving women in the development of new technologies, it becomes possible to create user-friendly, effective, and sustainable solutions. Access to training, credit facilities, and skill development programs should be ensured for women to foster their full participation in climate change initiatives. Empowering women in farm households translates into positive outcomes for overall agricultural productivity and resilience [2].

## 2. MATERIALS AND METHODS

The state of Karnataka was chosen for the study purposively as it is one of the largest rice producing region in Southern India and also researcher is hailing from the same state which would usher in good rapport building with the respondents. Two districts viz. Shimoga and Hassan were selected purposively on the basis of highest area under rice crop in Southern Transition Zone of Karnataka. Two taluks from each districts were selected randomly. Two villages from each taluk were selected randomly and from each of the selected village, fifteen women farmers were selected by using the random number table method. The sample constituted to a total of one hundred and twenty (120) respondents. The data was collected using a pre tested structured interview schedule and analysed using SPSS. The women farmers were personally interviewed by the researcher.

## 3. RESULTS AND DISCUSSION

### 3.1 Socio-Economic Profile of the Women Farmers

A socio-economic profile of the women farmers is presented in Table 1.

**Table 1. Distribution of women farmers according to their socio- economic characteristics**

Sl. No.	Variables	Frequency	Percentage
<b>1</b>	<b>Age</b>		
a.	Young age (up to 38 years)	25	20.84
b.	Middle age (38-56)	72	60.00
c.	Old age (>56 years)	23	19.16
<b>2</b>	<b>Education</b>		
a.	Illiterate /no schooling	21	17.50
b.	Functionally literate(can read and write)	7	5.80
c.	Primary school(up to 5 <sup>th</sup> class )	28	23.33
d.	Upper Primary school(up to 8 <sup>th</sup> class)	25	20.83
e.	Secondary (up to 10 <sup>th</sup> class )	16	13.33
f.	Higher secondary(up to 12 <sup>th</sup> class)	12	10.00
g.	Under graduation	11	9.20
<b>3</b>	<b>Farming Experience (in years)</b>		
a.	Low farming experience(9-16)	16	13.33
b.	Medium farming experience (16-23)	46	38.33
c.	High farming experience (23-30)	58	48.33
<b>4</b>	<b>Farm size</b>		
a.	Marginal (up to 1.00 ha)	23	19.17
b.	Small (1.00-2.00 ha)	33	27.5
c.	Semi-medium (2.00-4.00 ha)	48	40.00
d.	Medium (4.00-10.00 ha)	14	11.66
e.	Large (more than 10.00 ha )	2	1.67
<b>5</b>	<b>Annual income (in rupees)</b>		
a.	Low (Less than Rs. 70,069)	48	40.00
b.	Lower middle (Rs. 70,069 - Rs.2,73,099)	59	49.16
c.	Upper middle (Rs.2,73,099- Rs.8,45,955)	10	8.33
d.	High (More than Rs.8,45,955)	3	2.50
<b>6</b>	<b>Occupation</b>		
a.	Farming (alone)	31	25.83
b.	Farming along with other enterprises	89	74.16
<b>7</b>	<b>Asset possession</b>		
a.	Low	62	51.66
b.	Medium	38	31.67
c.	High	20	16.66
<b>8</b>	<b>Innovativeness</b>		
a.	Low	10	08.33
b.	Medium	80	66.66
c.	High	30	25.00
<b>9</b>	<b>Risk taking ability</b>		
a.	Low	40	33.33
b.	Moderate	49	40.83
c.	High	31	25.83
<b>10</b>	<b>Source of information</b>		
a.	Low	36	30.00
b.	Medium	70	58.33
c.	High	14	11.66
<b>11</b>	<b>Access to weather information</b>		
a.	Low	54	45.00
b.	Medium	40	37.50
c.	High	21	17.50
<b>12</b>	<b>Trainings undergone on Climate Resilient Agriculture (CRA)</b>		
a.	Low	60	50.00

Sl. No.	Variables	Frequency	Percentage
b.	Medium	38	31.67
c.	High	22	18.33
<b>13</b>	<b>Farming system</b>		
a.	Single crop (Agricultural or Horticultural crops)	3	2.5
b.	Agricultural crops + Horticultural crops	18	15.0
c.	Agricultural crops / Horticultural crops + Animal Husbandry/ goat/poultry	44	36.7
d.	Agricultural crops + Horticultural crops+ Animal Husbandry/ goat/poultry	55	45.8
<b>14</b>	<b>Availability of water resources</b>		
a.	Open wells	13	10.83
b.	Canals	18	15.00
c.	Farm pond	10	8.33
d.	Open wells+ Canals	29	24.16
e.	Open wells+ Farm pond + Canals	50	41.66
<b>15</b>	<b>Credit Availability</b>		
a.	Less	51	42.50
b.	Average	58	48.33
c.	More	11	9.16

From the overview of data (Table 1), majority of the women farmers in study sample were middle aged (60.00%), It might be due to the reason that respondents in the middle age group said they were free from child care and had comparatively fewer other domestic chores when compared to young women farmers. The old aged women farmers prefer to stay at home and unable to do heavy work due to physical strain. These findings were in line with study of Kumari [3].

It was evident that most of the women farmers i.e., 23.33 per cent possessed primary school education followed by upper primary school (20.83 %), illiterate (17.50 %), secondary school (13.33%), only meagre per cent had higher secondary (10.00%) and under graduation (9.20%). It can be concluded that majority of women farmers had primary and upper primary school education. The reasons for this disparity can be linked to a number of factors, most notably the shift in people's attitudes toward education and the availability of free education provided by the government, including various literacy programmes. Even though such facilities are provided, the study finds that (44.16%) could only finish primary and upper primary because rural women begin working on farms at a young age, giving no time for their further studies. The results were similar to that of Verma and Singh [4].

Majority of the women farmers had high farming experience (48.33%), followed by medium farming experience (38.33%) and low farming experience (13.33%). High level of farming

experience was observed as the rural women farmers concentrate on farming duties and get involved in economic activities at a young age. The results were in conformity with findings of Muttanna [5].

Majority of women farmers had semi medium farm size (40.00%), followed by small farm size (27.5%), marginal farm size (19.17%), medium (11.66%) and large farm size (1.67%). It may be due to sub division and fragmentation of agricultural land from one generation to next. The result was in line with Singotiya et al. [6].

Majority of the respondents (49.16%) were grouped under lower middle level of annual income, followed by low annual income (40.00%), upper middle annual income (8.33%) and high annual income (2.50%). It can be concluded that most of women farmers had Rs. 2,00,000 to 3,50,000 annual income; may be due to the farming system adopted, they could able to generate medium level of income from other crops or livestock. The result was in line with Supriya [7].

Majority of women farmers (74.16%) had farming along with other enterprises as their occupation and 25.83 per cent had farming alone as an occupation. It is evident from the results as they were able to better support their families by boosting their income through other additional activities like poultry, livestock and fisheries. And also to overcome the loss that occur due to the failure of their crop. The results were in conformity with findings of Bhairve [8].

From the results, it is observed that majority of the respondents (51.66%) had low asset possession, followed by medium (31.67%) and high asset possession (16.66%). It could be confirmed from the results that majority of women farmers had low asset possession as most of the women farmers expressed that they possessed the farm implements like plough, bullock cart, cultivators, seed drill during olden days but now everything has become mechanized and are replaced by the tractor which was taken on rental basis. The results were in conformity with findings of Muttanna (2013).

Further they displayed medium level of innovativeness (66.66%) followed by high (25.00%) level and low (8.33%) level of innovativeness. Medium innovativeness was seen because they prefer to follow the practices which were adopted and proven successful by their neighbor women farmers and also they preferred to take less to moderate risk as farming was their main occupation. The results were in conformity with findings of Vinay [9].

It was evident from the above data that most of the women farmers (40.83%) possessed moderate risk taking ability followed by low level of risk taking ability (33.33%) and high risk taking ability (25.83%). It might be because women farmers were ready to accept less to moderate risk involved practices which will not affect their livelihoods or farm income. An individual women farmer with good education, high farming experience, semi medium to medium land holding will make her to take moderate level of risk. The results were in conformity with findings of Vinay [9].

It could be vividly seen from the above table that majority of the women farmers had medium level of access to source of information (58.33%) as most of the women farmers had completed their primary and upper primary education, they were able to read news paper and they were ready to visit *Raitha Samparka Kendra* whenever they get doubts regarding new farming practices, subsidy, fertilizers etc. Most of the women farmers had access to television at their home. These results were similar to the findings of Ramesh [10].

It was observed that most (45.00%) of the respondents had low access to weather information followed by medium (37.50%) and high (17.50%) access to weather information. It can be concluded that majority of women farmers had low access to weather information due to the

reason that they might not be following weather based agro advisory services regularly. Hence more efforts from Agriculture officers/ KVKs are needed to create awareness about importance of weather information in tackling climate change related issues. These results were in conformity with findings of Nagasree et al. [11].

Low level of training was undergone on Climate Resilient Agriculture (CRA) (50.00%), due to the reason that majority of the times their husband or other male members of family attend the training programmes as women farmers have to look after the household chores. Women farmers suggested to conduct local training programmes which focus more on women farmers regarding climate change and its adaptation measures and also to employ more female extension officers to ensure their high participation. The results were in conformity with findings of Arathy [12].

Most of the women farmers had farming system of agricultural crops+ horticultural crops+ animal husbandary/ goat/poultry (45.8%), followed by Agricultural crops /Horticultural crops + Animal Husbandry /poultry / goat (36.7%), Agricultural crops + Horticultural crops (15%) and Single crop *i.e.*, Agricultural or Horticultural crops (2.5%). Thus, it can be concluded that women farmers adopted Agricultural crops + Horticultural crops + Animal Husbandry /poultry / goat farming system. This is likely due to the red clay soils of Shimoga and Hassan districts, which are ideal for cultivating rice and other plantation crops like arecanut, coffee and coconut *etc.* and also for the efficient utilization of soil and water resources. The results were in line with Ugwumba et al. [13].

The above results revealed that most of the women farmers expressed that they had access to either open wells or farm ponds with canals (41.66%) as the major source of irrigation followed by both canals and open wells (24.16%), canals (15.00%), open wells (10.83%) and a meagre per cent of them possessed farm ponds (8.33%) for irrigation purpose. This trend in results might be due to the attribution of Tunga dam in Shimoga which was main source for canal irrigation and due to good recharge of ground water table, open wells and farm ponds were also found to be serving the irrigation water requirement in the study area. Majority of the women farmers were dependent on rainfall for irrigation purpose as the districts selected fall under malnad region which faces heavy rainfall due to which they do not depend on other sources of irrigation in rainy season. Hence they

depend on canals, open wells and farm pond only in summer season. This is in conformity with the results of Praveena [14].

It was indicated that 48.33 per cent of the women farmers had availed average number of loans followed by less number of loans (42.50%) and more number of loans (9.16%). It can be concluded that the majority of the women farmers had availed average number of loans for taking up farming activities, it might be due to the low interest for agricultural loans charged by the banks and collateral free micro credits provided by the Self Help Groups. And also the financial assistance provided by the government viz Rs 6000 per year for the farmers. These results were in conformity with findings of Supriya [7].

### **3.2 Adaptation of Women Farmers to Climate Change**

The adaptation of women farmers towards climate change in rice crop is studied in terms of extent of preparedness of women farmers towards climate change and extent of adoption of various measures to face the climate change. The results on preparedness and adoption were presented below.

### **3.3 Extent of Preparedness of Women Farmers towards Climate Change in Rice Crop**

It was observed that majority of the respondents had medium preparedness towards climate change (55.00%), followed by low (26.66%) and high (18.33%) preparedness towards climate change. This could be attributed to their medium farm income, medium farm size, medium innovativeness and risk-taking ability. Women farmers are best prepared for successful technological adoption to face the climate change when extension workers make special efforts to reach out to them by conducting more number of method and result demonstrations to showcase value and relative worth of the new technologies. Zake and Hauser [15] in their study stated that men and women farmers deemed the implementation of climate change disaster preparedness at the community and village levels to be insufficient. This prompted farmers to take a variety of early actions in response to climate change disasters. These actions form an informal community-based early warning system for climate-change disasters. Kharumnuid et al.

[16] in their study found that majority of respondents (45.00%) had medium preparedness for adaptation followed by low (35.83%) and high (19.17%) preparedness for adaptation.

### **3.4 Preparedness towards Climate Change in Rice Crop**

Women farmers, when questioned about preparedness of climate change indications, they replied that majority of the respondents planned to change the sowing date according to onset of monsoon (I), followed by diversification of farm into different crops (II), planned to go for suitable varieties like drought resistant and early maturing varieties (III), planned to seek weather information before sowing (IV) and planned to take up agro advisory services from *Raitha Samparka Kendra* (V) this might be due to these practices may not require great deal of professionalism and do not demand lots of outside inputs where as lowest ranks were assigned on the statements like planned to take up flood resistant varieties in rice (XV), planned to take up climate resilient technologies like drum seeded technology and direct sowing to cope with climate change (XIV), planned for compensating the crop loss due to climate change (XIII), and planned to take up control measures against major pests in rice crop like Stem Borer, Brown Plant Hopper, Gundhi Bug etc (XII) because of lack of adequate technical knowledge and trouble comprehending the complexities involved in these practices. Banerjee et al. [17] in their study reported that women farmers from migrant-sending households are frequently in charge of disaster risk management and household resource management. The study aimed at strengthening autonomous measures like precautionary savings and household-level flood preparedness through gender-sensitive trainings and extension services which had influenced women to approach formal financial institutions. Md Ashrafuzzaman et al. [18] in their study on 'Exploring gender and climate change nexus, and empowering women in the South Western Coastal Region of Bangladesh for adaptation and mitigation' emphasized that Women should be prioritized in all policies, planning, and programs related to disaster management and also stated that it is essential to modernize the meteorological and hydrological networks for forecasting and warning systems.

**Table 2. Distribution of respondents item based on the rank order for each statement**

S. No	Items	Prepared	Not prepared	Rank
		%	%	
1.	Do you generally seek information on weather forecasting	68.3	31.7	IX
2.	Have you planned to go for suitable varieties like drought resistant and early maturing varieties	79.1	20.8	III
3.	Do you seek weather information before taking up the practices like sowing and transplantation	78.3	21.6	IV
4.	Have you diversified your farm into different crops	81.6	18.3	II
5.	Do you participate in training programmes related to climate resilient agriculture	70.8	29.1	VIII
6.	Have you planned to take up agro advisory services from Raitha Samparka Kendra	74.1	25.8	V
7.	Have you planned to take up flooding resistant varieties in rice	29.1	70.8	XV
8.	Have you planned to change the sowing date according to onset of monsoon	82.5	17.5	I
9.	Have you planned to obtain seed from authorized and formal seed agencies	68.3	31.6	IX
10.	Have you planned to take up rain water harvesting structures like farm ponds	65.0	35	XI
11.	Have you planned to take up soil test data based fertilizer application in order to get high yield	65.8	35.8	X
12.	Have you planned to take up recommended dose of fertilizers of N:P2O5:K2O in order to get high yield	71.6	28.3	VII
13.	Have you planned to take up climate resilient technologies like drum seeded technology, alternate wetting and drying (AWD), system of rice intensification (SRI) and direct sowing to cope with climate change	50	50	XIV
14.	Have you planned to take up control measures against major pests in rice crop like Stem Borer, Brown Plant Hopper, Gundhi Bug etc	62.5	37.5	XII
15.	Are you prepared for tackling the major disease in rice like rice blast, bacterial blight, sheath blight, rot disease etc	70.0	33.3	VI
16.	Are you prepared for compensating the crop loss due to climate change	60.0	40	XIII

### 3.5 Extent of Adoption of Various Measures to Face the Climate Change in Rice Crop

It was observed that majority of the respondents had medium adoption to face the climate change (56.66%) followed by low (35.83%) and high (7.50%) adoption to face the climate change in rice crop. The majority of respondents had medium adoption to deal with climate change in rice crop. This could be due to their medium farm income, medium farm size, medium innovativeness and asset possession. Jost et al.

[19] in their study on "Understanding gender dimensions of agriculture and climate change in smallholder farming communities" found that the most common changes made by women farmers in view of climate change were intercropping, adjusting the timing of weeding and harvesting, followed by dry planting before on set of rains, use of drought-resistant varieties and early planting. Rondhi et al. [20] in their study on "Assessing the role of the perceived impact of climate change on national adaptation policy: The case of rice farming in Indonesia" reported that women farmers have greater

climate change resilience and the ability to withstand climatic shocks and risks than male farmers. Female farmers are more optimistic about future farming conditions than male farmers.

### 3.6 Adoption of Various Measures to Climate Change in Rice Crop

Women farmers, when asked about adoption of various measures to climate change majority of them replied that they have adopted the practice of changing the planting dates (late sowing or early sowing) during late or early onset of monsoon and was ranked (I), followed by adoption of early maturing rice varieties due to early cessation of monsoon like Jyothi, IR-64, MTU 1010 was ranked (II), adoption of Mixed farming/Crop diversification/Crop rotation (III), adoption of recommended dosage of fertilizers(100:50:50:20 N:P2O5:K2O:S) (IV), stopped burning the crop residues at your farm (V). The reason for high adoption of these practices, because they were not technologically complex in nature and these methods were widely adopted as they were simple, easy to adopt, less expensive and does not demand more inputs from outside. Whereas, lowest ranks were allocated on the adoption statements like adoption of rice varieties tolerant to flood i.e. Swarna sub 1 (XIX), adoption of foliar spray of K based material or water soluble complex fertilizers (18:18:18) during dry spells (XVIII), adoption of rice varieties tolerant to drought like

IET-7191, KHP-2 (XVII), adoption of Aerobic Rice cultivation (XVI), adoption of the practice of alternate wetting and drying (XV), this was mainly due to lack of adequate technical guidance on the above practices, requirement of high cost inputs and low possession of assets like agricultural implements. The medium preparedness of women farmers to climate change and less number of trainings attended by the women farmers regarding climate change aspects also contribute to medium adoption. Edo et al (2023) in their study mentioned that majority of the respondents (49.4%) agreed that the adaptation strategies like farming calendar for rice as a major crop has changed. Lawson et al. (2020) in their study on “Dealing with climate change in semi-arid Ghana: Understanding intersectional perceptions and adaptation strategies of women farmers” revealed that majority of the adaptation practices adopted by women farmers were changing planting dates (100.00%), mixed farming (95.30%), intercropping (94.30%), planting early maturing varieties (76.40%), composting (62.30%) and off-farm activities (42.50%). Diarra et al. (2021) in their study on “Are perception and adaptation to climate variability and change of cowpea growers in Mali gender differentiated” found that most widely used soil and water conservation techniques were the use of organic manure (67.70%) and contour farming (64.20%), with significant (p0.05) differences between men and women.

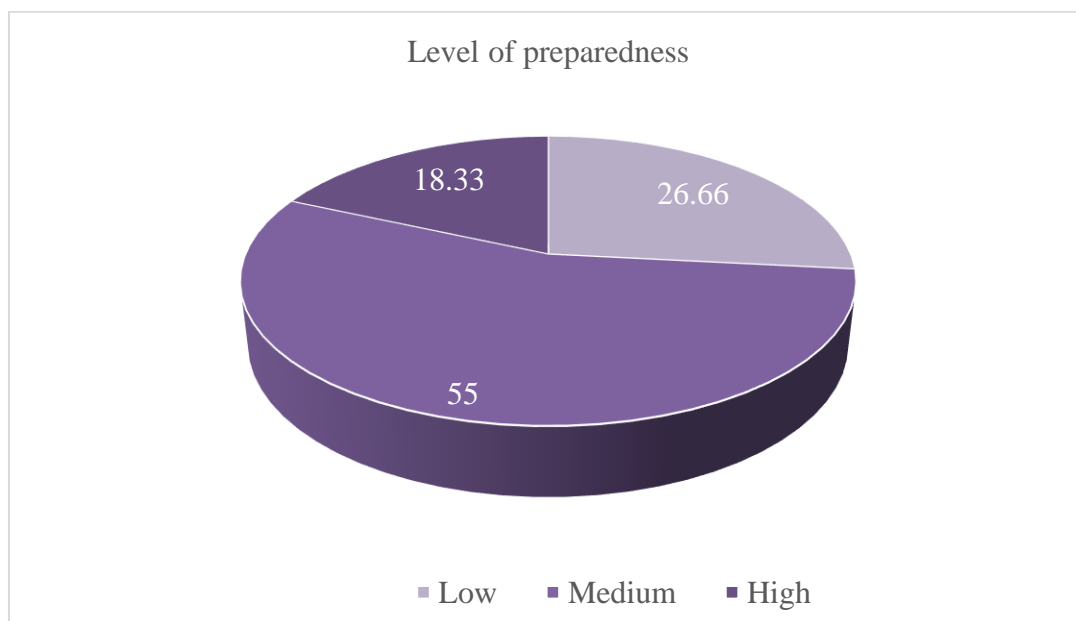
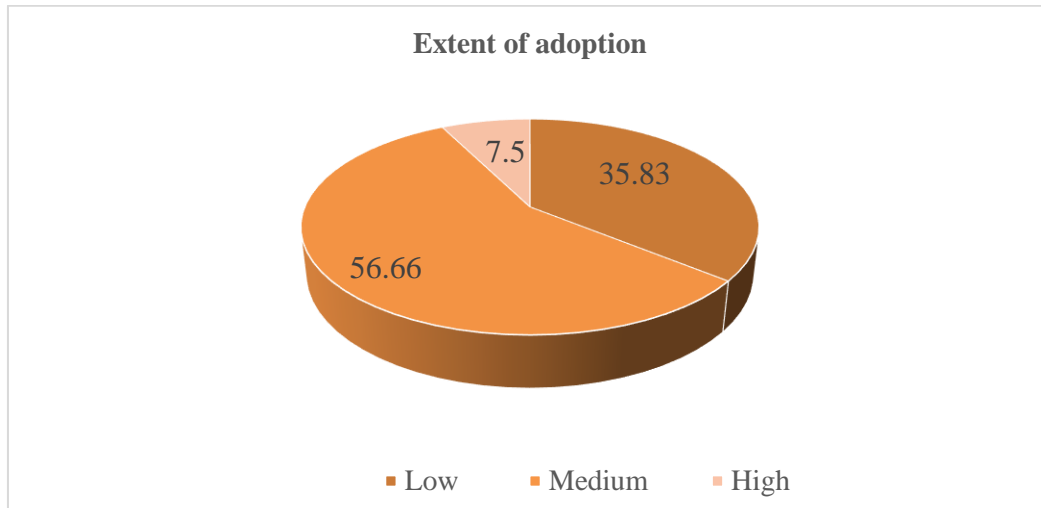


Fig. 1. Level of preparedness of women farmers on climate change in rice crop



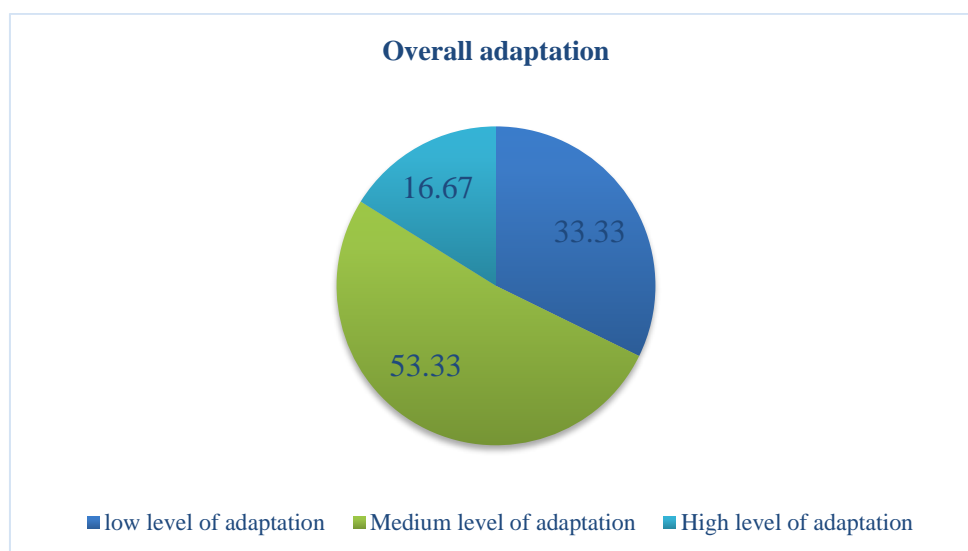


**Fig. 2. Level of adoption of women farmers on climate change in rice crop**

**Table 3. Distribution of respondents based on the rank order for each statement**

S. No	Items	Adopted	Partially adopted	Not adopted	Rank
		%	%	%	
1.	Have you adopted the practice of changing the planting dates(late sowing or early sowing)	85.00	15.00	-	I
2.	Have you adopted the use of early maturing rice varieties due to early cessation of monsoon (Jyothi, IR-64, MTU 1010)	70.00	16.66	8.33	II
3.	Did you adopt any rice varieties tolerant to flood (Swarna sub 1, FR13A)	-	-	100	XIX
4.	Did you adopt any rice varieties resistant to drought(IET-7191, KHP-2)	2.5	9.16	88.33	XVII
5.	Have you adopted improved irrigation methods during scarcity of rainfall	16.66	33.33	50.00	XIV
6.	Have you adopted rain water harvesting structures like farm pond in your farm	45.83	25.00	29.16	XI
7.	Have you adopted Mixed farming/Crop diversification/Crop rotation	71.66	20.00	83.33	III
8.	Have you adopted the integration of trees on rice farm(agro forestry)	54.16	30.00	15.83	IX
9.	Did you adopt the practice of direct seeded rice or dry sowing in rice	16.66	33.33	50.00	XIV
10.	Have you adopted climate resilient technologies like drum seeded technology to cope with climate change.	33.33	16.66	50.00	XIII
11.	Have you adopted the practice of alternate wetting and drying in your rice farm	8.33	25.00	66.66	XV
12.	Have you stopped burning the crop residues at your farm	66.66	25.00	8.33	V
13.	Have you adopted the Aerobic Rice cultivation in your farm	-	16.66	83.33	XVI
14.	Have you adopted the Systemic Rice Intensification (SRI) in your farm	33.33	41.66	25.00	XII
15.	Have you adopted soil test based fertilizer application in your farm	56.66	26.66	16.66	VIII

S. No	Items	Adopted	Partially adopted	Not adopted	Rank
		%	%	%	
16.	Have you adopted recommended dosage of fertilizers(100:50:50:20 N:P2O5:K2O:S)	70.83	20.83	8.33	IV
17.	Have you adopted any foliar spray of K based material or water soluble complex fertilizers (18:18:18) during dry spells?	1.66	8.33	90.00	XVIII
18.	Have you applied Bio fertilizers like Azospirillum 800 g / acre in your farm	54.16	29.16	16.66	X
19.	Have you adopted the use of herbicides for controlling the weeds like Echinochloacrusgalli in rice(Butachlor50 EC 75 ml in 25 litre )	66.66	25.00	8.33	V
20.	Have you adopted the use of pesticides for controlling the pest like Yellow Stem Borer (Monocrotophos 36 SL 1.5 ml in 1 litre ) and Gundhi Bug (Emamectin benzoate )	74.16	13.33	8.33	VI
21.	Have you adopted the use of chemicals for controlling the management of Blast disease in rice (Propiconazol 1.5 ml in 1L) and Smut (vitavax 1gm/litre )	68.33	18.33	13.33	VII
22.	Have you installed light traps for nocturnal and sucking pests in rice	25.00	16.66	58.33	XIV



Picture 1. Pie chart showing overall adaptation scenario

### 3.7 Overall Adaptation of Women Farmers to Climate Change in Rice Crop

Taking account the results of extent of preparedness and extent of adoption of various measures to face climate change in rice crop, it can be revealed that majority of the respondents had medium adaptation to face the climate change (53.33%) followed by low (30.00%) and high (16.67%) adaptation to face the climate change in rice crop. The results were in

conformity with findings of Muttanna (2010).

It can be observed that majority of women farmers had medium extent of adaptation to deal with climate change in rice crop. This could be due to their medium preparedness among women farmers regarding climate change. They were prepared for only those practices which were easy to understand, cost and input effective *etc.* and less prepared for technologies which

involve complexities in it. And medium adoption of various measures to combat climate change also contributed to medium adaptation of women farmers, as most of the women farmers had adopted the practices like changing the sowing date, diversification of farm, adopting early maturing rice varieties, application of recommended dose of fertilizer, soil testing *etc.* as they were easy to adopt and does not require any technical skills farmers. Medium farm size, good education, family members as source of information, high farming experience, medium innovativeness *etc* of women farmers resulted in medium adaptation to climate change. Antriandarti et al [21] in their study mentioned that although women are essential for numerous agricultural tasks, over 96% of female farmers do not take part in decision-making, instead deferring to their husbands or landowners. This disparity in gender and power, deeply rooted in social norms, prevents women from participating in activities beyond their traditional roles. Enhancing education, land ownership, and access to agricultural information can empower women to bridge this gap. The extent of adaptation by the women farmers to face climate change can be increased by conducting more number of training programs and small group discussions regularly by extension officers to increase women farmers' knowledge and skill towards new technology related to climate change and regular visits to the fields of successful women farmers. In addition to taking all of these steps, the government should ensure that essential inputs like seeds of flood and drought tolerant varieties, early maturing varieties, organic and biological inputs to maintain soil fertility and to control pest and diseases, plant protection, farm equipment and machinery are made available. According to Ferdushi et al. [22], approximately 69.3% of the female farmers and 7.1% of the male farmers had followed adaptation strategies, such as crop rotation and cultivating flood-tolerant rice, following the flash flood as majority of the male farmers opted to migrate to find work elsewhere, while the female farmers chose a different approach. They preferred to secure credit loans from NGOs to either rebuild their livelihoods or adapt to the changing climate conditions. Adzawla et al. [23] studied that the main climate adaptation strategies adopted by both male and female farmers were changing planting dates to match with the season, row planting, planting early maturing and drought tolerant seed varieties, mixed farming, intercropping and refilling of farm plots and also the gender

difference in climate adaptation as observed in this study is due to differences in the levels and intensity of adoption and not the type of strategy adopted by the various gender groups.

### **3.8 Relation between Characteristics of Women Farmers and their Extent of Adaptation to Climate Change in Rice Crop**

The coefficient of correlation was calculated to determine the relationship between selected characteristics of women farmers and their extent of adaptation to climate change in rice crop.

Data on the correlation between selected socio economic, personal and psychological characteristics comprised of age, education, farming experience, farm size, farming system, annual income, availability of water resources, credit availability, innovativeness, risk taking ability, sources of information, access to weather information, trainings undergone on Climate Resilient Agriculture (CRA) and their extent of adaptation towards climate change.

It is clear from the above table that out of thirteen independent variables selected to study the relationship with extent of adaptation of women farmers towards climate change, all the variables except credit availability were found to have positive (and significant) relationship with the dependent variable *i.e.*, extent of adaptation of women farmers. Further, two variables *i.e.*, education and farming experience– was found to have significant positive relationship with women farmer's extent of adaptation at 1 per cent level of significance, it might be due to the fact that higher degree of education is thought to be related to having access to information about new technology, climatic information and productivity repercussions. Education level enhances women farmers' interest to try with new technology and learn their benefits before ultimate adoption. Highly experienced female farmers have more options for adapting to new technologies because they are more likely to be aware and knowledgeable about changes in climatic conditions and crop management practices. These findings align with Khorshed's [24] findings, which show that farmers with more farming experience, higher education, and better access to power and institutional facilities were more likely to utilize alternative adaptation techniques to resist climate change.

**Table 4. Correlation between the selected characteristics of women farmers and extent of adaptation to climate change in rice crop**

Sl. No.	Variables	Adaptation (calculated 'r' value)
1	Age	0.272*
2	Education	0.250**
3	Farming experience	0.284**
4	Farm size	0.226*
5	Farming system	0.156
6	Annual income	0.056
7	Availability of water resources	0.229*
8	Credit availability	-0.052
9	Innovativeness	0.234*
10	Risk taking ability	0.210*
11	Sources of information	0.205*
12	Access to weather information	0.158
13	Trainings undergone on Climate Resilient Agriculture(CRA)	0.198*

The remaining ten variables were found to be significant at 5 per cent level of significance as old aged women farmers are better informed about climate change and more prepared to adopt the best management strategies because they choose them based on their experience and prior success or failure. Women farmers who own larger farm size tend to grow more crops on their land and choose to diversify their farming methods thus, adopting new technologies in their farm. This result is in line with the findings of James et al. [2]. Women farmers with more availability of water resources are able to adopt more than one crop as for each crops, package of practices depends on irrigation facility which also allow them to irrigate fields at crucial phases. Sources of information have a significant impact on women farmers' adoption of new technology by attracting their attention through mass media and individual contact methods, allowing them to adapt to climate change. Mandleni and Anim [25] found that gender, formal extension, climate change information, temperatures, and land acquisition method all had a substantial impact on adaption selections. According to Ahmed's [26] findings, the degree of adaptation to any technology is directly related to the level of risk that women farmers choose, tolerate, and experience [27,28]. As this level of risk receptivity rises, so does the degree of acceptance of new technologies. Women farmers with more innovativeness will essentially demonstrate a willingness to attempt new things, which tends to lead her to get more information

about those new ideas and methods that may have helped her to realize higher CRA technology efficacy. Trainings on CRA technologies will enhance the knowledge and skills of women farmers which enables them to change their perception towards new technologies and influence them to make successful changes in their management practices and adopt CRA technologies in their farm [29].

#### 4. CONCLUSION

The study concluded that majority of women farmers had medium extent of adaptation to deal with climate change in rice crop. This could be due to their medium preparedness among women farmers regarding climate change. They were prepared for only those practices which were easy to understand, cost and input effective *etc.* and less prepared for technologies which involve complexities in it. And medium adoption of various measures to combat climate change also contributed to medium adaptation of women farmers, as most of the women farmers had adopted the practices like changing the sowing date, diversification of farm, adopting early maturing rice varieties, application of recommended dose of fertilizer, soil testing *etc.* as they were easy to adopt and does not require any technical skills. Medium farm size, good education, family members as source of information, high farming experience, medium innovativeness *etc.* of women farmers resulted in medium adaptation to climate change. The extent of adaptation by the women farmers to face climate change can be increased by conducting more number of training programme and small group discussions regularly by extension officers to increase women farmers' knowledge and skill towards new technology related to climate change and regular visits to the fields of successful women farmers. In addition to taking all of these steps, the government should ensure that essential inputs like seeds of flood and drought tolerant varieties, early maturing varieties, organic and biological inputs to maintain soil fertility and to control pest and diseases, plant protection, farm equipment and machinery are made available. Thus, the Department of Agriculture should take a step forward to disseminate accurate, timely and trustworthy technical information to the women farmers through training programmes, group discussions, field visits *etc.* *Raitha samparka Kendras* should emphasize more importance for women farmers in providing agro advisory

services. Additionally, a kind of team spirit should be aroused among the women farmers to reap the benefits of collective decision-making and to follow group action to put technique into practice as an efficient preparedness measure to overcome the climate change. The present study is limited to only two districts in the state of Karnataka. A similar study might be conducted in other districts of the state. Case studies on successful women farmers can be taken up to critically understand the various practices involved in the adaptation to climate change.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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