The Level of Rice Farmers' Adoption of Smart Climate Agriculture

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Authors’ contributions

This work was carried out in collaboration among all authors. Author NCK designed the study, collected the data and wrote the first draft of the manuscript. Authors GT and GG managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To know the adaptation strategies undertaken by the respondents to deal with climate-smart agriculture.

Study Design: An expost facto research design was employed to analyse the level of adoption by the rice farmers.

Place and Duration of Study: The study was conducted during 2018-19 in Dharwad district of Karnataka state. From Dharwad district two villages namely Mummigatti from Dharwad taluk and Jodalli from Kalaghatagi taluk were selected.

Methodology: A total of 60 respondents were randomly selected and personally interviewed. To elicit the required information from the respondents, a structured interview schedule was prepared. Through informal discussions and interviews, data was collected from the respondents. The collected data was analysed with the help of suitable statistical tools like frequency, percentage, mean, standard deviation and t-test.

Results: The results of the study revealed that majority of the respondents from Mummigatti (86.67%) and Jodalli (66.70%) had medium level of awareness regarding climate-smart agriculture. Majority of the respondents from Mummigatti (80.00%) and Jodalli (73.30%) were found in medium
adaptation category. Equal percentage (20.00% each) of the respondents from both the villages belonged to the high adaptation category. The study also reveals that cent percent of the respondents from both the villages were faced constraints like lack of knowledge about adaptive practices, lack of awareness about climate change issues, non-availability of inputs in time, lack of financial resource, poor support of local and national authorities with the climate-related issue and higher cost of the agricultural inputs to cope with climatic variability.

**Conclusion:** From the study, it can be concluded that providing information and local support from the authorities will be of immense use in the proper adaption of site-specific climate-smart practices. The study also suggests that suitable policies and strategies should be taken to deal with non-adaptation of climate-smart practices in the villages.

**Keywords:** Adoption; awareness; climate smart; climate change.

1. **INTRODUCTION**

In the present time climate change has become one of the biggest developmental as well as an environmental challenge. It has been proved that climate change is already having an impact on agriculture and food security as a result of the increased prevalence of extreme events and increased unpredictability of weather patterns [1,2]. In this context, the concept of climate-smart agriculture (CSA) has too much relevance and it is not a single specific agricultural technology or practise that can be universally applied, such as conservation or organic agriculture, although either may be key components of a CSA strategy in specific locations and countries [3,4].

CSA is an approach to developing the technical, policy and investment conditions the enabling environment to support actions aimed at achieving sustainable agricultural development for food and nutrition security under a changing climate [5]. With this background the research study was conducted with the following objectives:

1. To study the awareness of respondents regarding climate-smart agriculture.
2. To know the adaptation strategies undertaken by the respondents to deal with climate-smart agriculture.
3. To identify the constraints faced by respondents during the adaptation of climate-smart agriculture.

2. **MATERIALS AND METHODS**

The study was conducted during 2018-19 in Dharwad district of Karnataka state. From Dharwad district two villages namely Mummigatti from Dharwad taluk and Jodalli from Kalaghatagi taluk were selected. A total of 60 respondents i.e., 30 from Mummigatti and 30 from Jodalli were randomly selected. To elicit the required information from the respondents, a structured interview schedule was prepared. Through informal discussions and interviews, data was collected from the respondents. The collected data was analysed with the help of suitable statistical tools like frequency, percentage, mean, standard deviation and discussed as results.

3. **RESULTS AND DISCUSSION**

The data presented in Table 1 depicts the socio-economic characteristics of the respondents. The majority (66.70%) of the respondents from Jodalli village belongs to the adult age group, whereas half of the respondents from Mummigatti village belongs to adult and old category (50.00% each). Concerning education majority of the respondents from both villages i.e. 76.67 per cent from Mummigatti and 73.30 per cent from Jodalli were illiterate. None of the respondents from both the villages not completed secondary school and graduation.

Concerning land holding half of the respondents from Mummigatti village had semi medium land holding followed by Small (30.00%), Medium (16.70%) and large (3.30%). Whereas 40.00 per cent of the Jodalli village respondents had Small landholdings followed by Semi medium (33.30%), Marginal (20.00%) and Medium (26.70%) landholdings. None of the respondents from Jodalli village possessed large
landholdings. Family income of the respondents revealed that 96.70 per cent of the Mummigatti respondents and cent per cent of the Jodalli respondents had low level of income.

The data on social participation revealed that majority of the respondents from Mummigatti village had a medium level of social participation followed by low and high social participation. Table 1 also revealed that majority of the respondents from both the villages had a medium level of extension contact followed by low extension contact and none of them found in the high category. Data on mass media exposure showed that equal per cent (56.70% each) of the respondents from both the villages had medium exposure to mass media.

The data in Table 2 reveals that cent percent of the respondents from both the villages had awareness about short-duration varieties. But they possess less awareness about disease and pest resistant varieties, drought-tolerant varieties. None of them had awareness about direct-seeded rice.

With respect, agro diversification cent percent of the respondents from Mummigatti and Jodalli villages had awareness about the crop-tree system, crop-livestock system, cropping pattern and calendar of planting, mixed cropping, crop rotation, crop-tree-livestock system. None of the respondents from both villages had awareness regarding reduced tillage and cultivation of paddy through SRI technique.

Table 1. Socio-economic characteristics of the respondents (n=60)

| Sl. no. | Characteristics   | Mummigatti (n1=30) | Jodalli (n2=30) |
|---------|-------------------|--------------------|-----------------|
|         |                   | F (%)              | F (%)           |
| 1.      | Age               |                    |                 |
|         | Young             | -                  | 02 66.70        |
|         | Adults            | 15 50.00           | 20 66.70        |
|         | Old               | 15 50.00           | 08 26.70        |
| 2.      | Education         |                    |                 |
|         | Functional        | 02 06.70           | 03 10.00        |
|         | Illiterate        | 23 76.67           | 22 73.30        |
|         | Primary           | 04 16.70           | 05 16.70        |
|         | Middle            | 01 03.30           | -               |
|         | Secondary         | -                  | -               |
|         | Graduation and Above | -          | -               |
| 3.      | Family size       |                    |                 |
|         | Small             | 04 13.30           | 07 23.30        |
|         | Medium            | 20 66.70           | 15 50.00        |
|         | Large             | 06 20.00           | 08 26.70        |
| 4.      | Farming Experience|                    |                 |
|         | Low (Years)       | 05 16.70           | 05 16.70        |
|         | Medium (Years)    | 17 56.70           | 21 70.00        |
|         | High (Years)      | 08 26.70           | 04 13.30        |
| 5.      | Land Holding      |                    |                 |
|         | Marginal          | -                  | 6 20.00         |
|         | Small             | 09 30.00           | 12 40.00        |
|         | Semi Medium       | 15 50.00           | 10 33.30        |
|         | Medium            | 05 16.70           | 08 26.70        |
|         | Large             | 01 03.30           | -               |
| 6.      | Family Income     |                    |                 |
|         | Low               | 29 96.70           | 30 100.00       |
|         | Medium            | 01 03.30           | -               |
|         | High              | -                  | -               |
| 7.      | Social Participation|                |                 |
|         | Low               | 08 26.70           | 28 93.33        |
|         | Medium            | 17 56.70           | 02 06.67        |
|         | High              | 05 16.60           | -               |
| 8.      | Extension Contact |                    |                 |
|         | Low               | 22 73.30           | 23 76.67        |
|         | Medium            | 08 26.70           | 07 23.33        |
|         | High              | -                  | -               |
| 9.      | Mass media Exposure|                |                 |
|         | Low               | 08 26.70           | 05 16.70        |
|         | Medium            | 17 56.70           | 17 56.70        |
|         | High              | 05 16.60           | 08 26.70        |
Table 2. Awareness of respondents regarding climate smart agriculture (n=60)

| Sl. no | Items                                                                 | Mummigatti (n₁=30) | Jodalli (n₂=30) |
|--------|-----------------------------------------------------------------------|---------------------|-----------------|
|        | **Varieties**                                                        |                     |                 |
| 1      | Awareness regarding short duration varieties                         | 100.00              | 100.00          |
| 2      | Awareness regarding benefit of direct-seeded rice                    | 0.00                | 0.00            |
| 3      | Awareness regarding disease-resistant varieties                      | 16.70               | 13.30           |
| 4      | Awareness regarding insect-pest resistant varieties                  | 16.70               | 13.30           |
| 5      | Awareness regarding drought tolerant varieties                        | 16.70               | 13.30           |
|        | **Agro-diversification**                                             |                     |                 |
| 6      | Awareness regarding crop-tree system                                 | 100.00              | 100.00          |
| 7      | Awareness regarding the crop-livestock system                        | 100.00              | 100.00          |
| 8      | Awareness regarding change in cropping pattern and calendar of planting | 100.00              | 100.00          |
| 9      | Awareness regarding mixed cropping                                   | 100.00              | 100.00          |
| 10     | Awareness regarding crop rotation                                    | 100.00              | 100.00          |
| 11     | Awareness regarding reduced tillage                                  | 0.00                | 0.00            |
| 12     | Awareness regarding crop tree livestock system                        | 100.00              | 100.00          |
| 13     | Awareness regarding fallow land                                      | 100.00              | 100.00          |
| 14     | Awareness regarding judicious use of insecticides and pesticides     | 60.00               | 20.00           |
| 15     | Awareness regarding the integrated farming system model              | 100.00              | 60.00           |
| 16     | Awareness regarding spacing between rows/plants                       | 100.00              | 100.00          |
| 17     | Awareness regarding the cultivation of paddy through SRI technique   | 0.00                | 0.00            |
|        | **Water management**                                                 |                     |                 |
| 18     | Awareness regarding irrigation scheduling                            | 80.00               | 60.00           |
| 19     | Awareness regarding water-efficient crops                            | 20.00               | 10.00           |
| 20     | Awareness regarding the choice of irrigation methods                 | 40.00               | 20.00           |
| 21     | Awareness regarding micro irrigation                                 | 60.00               | 40.00           |
| 22     | Awareness regarding contour farming                                  | 60.00               | 20.00           |
| 23     | Awareness regarding water harvesting                                 | 80.00               | 60.00           |
| 24     | Awareness regarding drainage                                         | 16.70               | 3.30            |
| 25     | Awareness regarding judicious use of underground water               | 3.30                | 3.30            |
|        | **Soil conservation**                                                |                     |                 |
| 26     | Awareness regarding use of cover crops                              | 3.30                | 0.00            |
| 27     | Awareness regarding mulching                                        | 3.30                | 0.00            |
| 28     | Awareness regarding live barriers/fence                              | 60.00               | 40.00           |
| 29     | Awareness regarding plantation trees                                 | 100.00              | 100.00          |
|        | **Soil management**                                                 |                     |                 |
| 30     | Awareness regarding organic fertilizer                               | 60.00               | 60.00           |
| 31     | Awareness regarding legumes and green manure                         | 60.00               | 40.00           |
| 32     | Awareness regarding use of compost                                  | 100.00              | 100.00          |
| 33     | Awareness regarding use of animal manure                            | 100.00              | 100.00          |
| 34     | Awareness regarding bio-fertilizer                                  | 3.30                | 0.00            |
| 35     | Awareness regarding integrated nutrient management                   | 3.30                | 0.00            |
| 36     | Awareness regarding scheduled fertilizer                             | 3.30                | 0.00            |
| Mean   |                                                                       | 2.13                | 1.86            |
| SD     |                                                                       | 0.34                | 0.57            |
| t-value|                                                                       | 2.18*               |                 |

Note: SD-Standard Deviation, *: Significant at 0.05% level

The data about water management reveals that majority of the respondents had awareness about irrigation scheduling (80.00% & 60.00%) and water harvesting (60.00% &
40.00%), whereas with respect to other water management aspects like water-efficient crops (20.00% & 10.00%), irrigation methods (40.00% & 20.00%), drainage (16.70% & 3.30%) and judicious use of underground water (3.30% each) they possessed less awareness.

About soil conservation and management aspect cent percent of them had awareness about plantation trees, compost and animal manure. Whereas less percent of the respondents had awareness about cover crops, mulching, bio-fertiliser and integrated nutrient management.

The data presented in the Fig. 1 reveals that majority of the respondents from Mummigatti (86.67%) and Jodalli (66.70) had medium level of awareness regarding climate-smart agriculture. The reason might be farming experience and local cosmopolite nature of the respondents. Whereas, 13.30 per cent and 10.00 per cent them possessed a high level of awareness respectively. None of the respondents from Mummigatti village belongs to low level of awareness but 23.30 per cent of the respondents from Jodalli village had low level of awareness regarding climate-smart agriculture.

An analysis of data presented in Table 3 depicts that cent per cent of the respondents were adapted to short duration crops like maize, rice, jowar, brinjal, soya, tomato etc... in their field. High majority of the respondents from Mummigatti adapted disease and pest resistant varieties (80.00% each) to cope with extreme climatic changes, whereas the same strategies were adapted by 50 00 percent of the Jodalli respondents.

The table also reveals the adaptation strategies followed by respondents concerning agro diversification. Which includes crop-livestock system, change in cropping pattern, calendar of planting, mixed cropping, crop rotation, spacing between rows/plants and change in cropping pattern & calendar of planting. Whereas less percent of the respondents from both the villages adopted strategies like judicious use of insecticides and pesticides, fallow land, crop-tree system, crop-tree-livestock system and integrated farming model. None of the respondents from both villages not adapted reduced tillage and cultivation of rice through SRI technique. Because they don’t possess awareness and knowledge about the specified practices.

Concerning water management, majority of the respondents from Mummigatti (60.00%) and Jodalli (40.00%) adapted irrigation scheduling, as they were aware of the time and stages of irrigation. Less percent of the respondents from both village (ranging from 3.33% to 20.00%) adapted strategies like water-efficient crops, choice of irrigation methods, contour farming and water harvesting. None of the respondents from both the villages adapted strategies like water-efficient crops, micro irrigation, drainage and judicious use of underground water. Lack of awareness, financial resources and less landholding were the major reasons for non-adaptation of particular strategies.

Less percentage (ranging from 3.33% to 20.00%) of the respondents from both villages adapted strategies like use of cover crops, mulching, live barriers/fence, plantation trees, organic fertilizer, use of compost, use of animal manure and scheduled fertilizer. None of the respondents from both villages adapted strategies like use of cover crops, legumes & green manure, bio-fertilizer and integrated nutrient management.

![Fig. 1. Extent of awareness regarding climate smart agriculture](image-url)
Table 3. Adaptation strategies regarding climate-smart agriculture (n=60)

| Sl. no | Items                                                                 | Mummigatti (n₁=30) | Jodalli (n₂=30) |
|--------|------------------------------------------------------------------------|---------------------|-----------------|
|        |                                                                        |                     |                 |
|        | **Varieties**                                                          |                     |                 |
| 1      | Short duration varieties                                              | 100.00             | 100.00          |
| 2      | Direct seeded rice                                                    | 00.00              | 00.00           |
| 3      | Disease resistant varieties                                           | 80.00              | 50.00           |
| 4      | Insect-pest resistant varieties                                       | 80.00              | 50.00           |
| 5      | Awareness regarding drought tolerant varieties                         | 00.00              | 00.00           |
|        | **Agro-diversification**                                              |                     |                 |
| 6      | Crop-tree system                                                      | 20.00              | 20.00           |
| 7      | Crop-livestock system                                                | 100.00             | 100.00          |
| 8      | Change in cropping pattern and calendar of planting                   | 60.00              | 60.00           |
| 9      | Mixed cropping                                                        | 100.00             | 100.00          |
| 10     | Crop rotation                                                         | 100.00             | 100.00          |
| 11     | Reduced tillage                                                       | 00.00              | 00.00           |
| 12     | Crop tree livestock system                                            | 20.00              | 20.00           |
| 13     | Fallow land                                                           | 10.00              | 10.00           |
| 14     | Judicious use of insecticides and pesticides                          | 40.00              | 20.00           |
| 15     | Integrated farming system model                                       | 20.00              | 20.00           |
| 16     | Spacing between rows/plants                                           | 100.00             | 100.00          |
| 17     | Cultivation of paddy through SRI technique                            | 0.00               | 0.00            |
|        | **Water management**                                                  |                     |                 |
| 18     | Irrigation scheduling                                                | 60.00              | 40.00           |
| 19     | Water efficient crops                                                | 00.00              | 00.00           |
| 20     | Choice of irrigation methods                                          | 20.00              | 20.00           |
| 21     | Micro irrigation                                                      | 00.00              | 00.00           |
| 22     | Contour farming                                                       | 20.00              | 10.00           |
| 23     | Water harvesting                                                      | 20.00              | 10.00           |
| 24     | Drainage                                                              | 00.00              | 00.00           |
| 25     | Judicious use of underground water                                    | 0.00               | 0.00            |
|        | **Soil conservation**                                                 |                     |                 |
| 26     | Use of cover crops                                                    | 20.00              | 00.00           |
| 27     | Mulching                                                              | 20.00              | 03.33           |
| 28     | Live barriers/fence                                                  | 20.00              | 03.33           |
| 29     | Plantation trees                                                      | 20.00              | 03.33           |
|        | **Soil management**                                                   |                     |                 |
| 30     | Organic fertilizer                                                    | 20.00              | 10.00           |
| 31     | Legumes and green manure                                              | 00.00              | 00.00           |
| 32     | Use of compost                                                        | 20.00              | 13.33           |
| 33     | Use of animal manure                                                  | 20.00              | 13.33           |
| 34     | Bio-fertilizer                                                        | 00.00              | 00.00           |
| 35     | Integrated nutrient management                                        | 00.00              | 00.00           |
| 36     | Scheduled fertilizer                                                  | 20.00              | 13.33           |
|        | **Mean**                                                              | 2.20               | 2.13            |
|        | **SD**                                                                | 0.40               | 0.50            |
|        | **t-value**                                                           | 0.56NS             |                 |

Note: SD-Standard Deviation, NS-Non Significant

Lack of awareness about adaptive practices might be the reason for non-adaptation of strategies.

Observations from the Fig. 2 reveal that majority of the respondents from Mummigatti (80.00%) and Jodalli (73.30%) were found in medium adaptation category. Equal percentage (20.00% each) of the respondents from both the villages belonged to high adaptation category. None of the respondents from Mummigatti village were found in low adaptation category, whereas 6.70 per cent of the Jodalli respondents belonged to low adaptation category.
Fig. 2. Extent of adaptation strategies regarding climate smart agriculture

Table 4. Constraints faced by respondents during adaptation

| Sl. no | Constraint                                                                 | Rank Mummigatti | Rank Jodalli |
|-------|-----------------------------------------------------------------------------|-----------------|--------------|
| 1.    | Lack of knowledge about adaptive practices                                  | 100.00          | 100.00       |
| 2.    | Lack of awareness about climate change issues                               | 100.00          | 100.00       |
| 3.    | Non availability of inputs in time                                          | 100.00          | 100.00       |
| 4.    | Lack of improved communication facility                                     | 26.70           | 60.70        |
| 5.    | Lack of financial resource                                                  | 100.00          | 100.00       |
| 6.    | Poor support of local and national authorities with climate related issue   | 100.00          | 100.00       |
| 7.    | Unavailability of new technologies                                          | 23.30           | 60.70        |
| 8.    | Migration of youth                                                          | 16.70           | 36.70        |
| 9.    | Lack of knowledge about post harvest technologies                           | 30.00           | 100.00       |
| 10.   | Higher cost of the agricultural inputs                                      | 100.00          | 100.00       |

The data from the Table 4 depicts that cent percent of the respondents from both the villages were faced constraints like lack of knowledge about adaptive practices, Lack of awareness about climate change issues, non-availability of inputs in time, lack of financial resource, poor support of local and national authorities with climate-related issue and higher cost of the agricultural inputs. Other constraints faced by the respondents include Lack of knowledge about post-harvest technologies, lack of improved communication facility, Unavailability of new technologies, Migration of youth.

4. CONCLUSION

Providing information and local support from the authorities will be of immense use in the proper adoption of site-specific climate smart practices as majority of the respondents had medium level of awareness about climate-smart agriculture and its relevance in the future implications. Suitable policies and strategies should be taken in order to deal with non-adaptation of climate-smart practices in the villages which helps the small land holders to adapt to climate change without any obstructions.

CONSENT

As per international standard or university standard, respondents’ written consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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