P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 9; September 2024; Page No. 467-472

Received: 14-06-2024
Accepted: 24-07-2024

Indexed Journal
Peer Reviewed Journal

Adaptation pattern regarding climate change by rural women in Haryana

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DOI: https://doi.org/10.33545/26180723.2024.v7.i9g.1102

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Abstract

The article emphasizes that, India is extremely vulnerable to the impacts of climate change and significant measures are needed to build their knowledge level with the adaptation climate resilience. A study titled "Adaptation pattern regarding climate change by rural women in Haryana" was carried out in the district of Hisar. The sample consisted of 120 rural women from four villages in Hisar (30 from each village), and two villages from Hisar-I and two villages from Hisar-II were selected randomly. The objective of the present study were to explore the adaptation pattern by rural women regarding climate change. The data was collected regarding dependent and independent variables with the help of developed interview schedule and a set of 19 independent variables and 1 dependent variable were selected for the study. The collected data were analyzed with suitable statistical tools and techniques such as frequency and percentage score to reveal the major findings. The major findings revealed that the most adopted practices followed by rural women for crop production was contingent crop plan followed by use of ridges and furrows for energy and water resources, whereas for animal husbandry they mostly adopted the shifting shed location of the livestock. The rural women also had alternative of worked at lower wages to generate income after any natural calamities.

Keywords: Climate change, adaptation, vulnerable, rural women, explore, practices, crop production, livestock, generate income

Introduction

India should be concerned about climate change since a large portion of its population relies on industries that are vulnerable to it, such as cultivation, forestry and fisheries. The negative effects of climate change, such as less rainfall and an increase in temperature, have made it more difficult for people to make a living. The ecological and social systems, which are already under a great deal of stress as a result of the fast industrialization, urbanization and economic development will be further stressed by climate change. According to the latest scientific assessment, the earth's climate system has changed demonstrably from pre-industrial times on a global and regional scale (Balasubramanian and Birundha, 2012) [4]. The food security, home energy and water availability are just a few examples of traditionally female-dominated fields that will be disproportionately affected by the effects of climate change and will require greater adaptation. It should be mentioned that women frequently have little influence over decisions made by their families or the society, which prevents them from being able to diversify their farming in order to adapt to climate change (Rodenberg, 2009) [17]. Adaptation to climate change refers to the adjustment in reaction to climatic conditions and their impacts such as ecological, social and economic systems. Adaptation is a human response to the effects of climate change. Another definition of adaptation that it is a process which includes learning about risks, evaluating response options, creating the conditions that enable adaptation, mobilizing resources and updating decisions in light of new information (Tseng *et al.*, 2011) [19]. Climate change would lower the incomes of the vulnerable populations and increase the absolute number of people at risk of hunger. Climate change will significantly impact on crop development, growth, water usage and productivity (Singh *et al.*, 2010) [18]

Reviews of literature

Ahmed *et al.* (2007) [1] reported that women typically built houses in rural areas without using mud and instead used bamboo or wood to allow water to travel through the structure readily in the event of flooding. In addition, the dwellings' plinth height had been increased to a specific level to minimise damage during periods of heavy rain. To preserve vital documents related to dry food (Cheera Muri), such as rice, lentils, salt, sugar and other materials such as matchsticks, candles, kerosene and seeds, safe during times of water logging and flooding, raised platforms resembling ceilings were created inside the homes.

Nhemachena and Hassan (2007) [15] found that households with female head of home were more likely to implement climate change adaptation techniques. This finding might be explained by the fact that in the majority of the rural smallholder farming groups in the area, women performed a significant share of the agricultural effort. Because they handled the majority of the agricultural work, whereas men were more usually found in towns, therefore women had more expertise in farming and understanding of different management techniques. Women had the ability to modify their farming techniques in response to shifting climatic circumstances as well as other variables including market conditions and household food requirements.

Dankelman *et al.* (2008) [7] concluded that women likely contributed significantly to the efforts required to address climate hazards by performing some infrastructure development to protect the soil, water and to prevent floods by creating embankments. For instance, Senegalese women's associations had helped build crescent-shaped canals in the Keur Moussa village to retain water, restore crop land and boost agricultural productivity.

Deressa *et al.* (2008) [8] examined the Ethiopian farmers' responses to climate change, including their adaption measures. It was discovered that most farmers did nothing in response to these shocks, primarily because they were poor. Farmers who made an effort to combat the negative effects of the shocks primarily did so by borrowing money from family members, selling livestock, taking part in food for work programmes and seeking food help.

Bahadur *et al.* (2008) [3] conducted a study on an integrated strategy for coping with climate change found that inhabitants in the Chitwan district of Central Nepal had seen hotter summers, while winters were getting shorter. They discovered that while (98.00%) of villagers acknowledged climatic changes, (95.00%) cited drought and unpredictable rainfall patterns as the primary warning signs.

Hassan and Nhemachena (2008) [12] determined the climate adaption strategies for farms or farm level. Farmers had adapted multiple cropping and mixed cropping. In dry areas increased precipitation decreases the probability of irrigation. Adapting to climate change is necessary for access to the market, information and credit services.

Wajih and Shiraz (2008) [20] reported that according to survey, farmers in the Eastern Uttar Pradesh regions had implemented a variety of climate change adaptation strategies, including crop intensification, diversification, value addition and crop cycle management, such as pre-flood cultivation, cropping during floods and post-flood cultivation.

Pande and Akermann (2009) revealed that farmers cited the necessity for weather alerts (71.00%) and agricultural insurance (74.00%) as tools for efficient adaptation. There were also efficient meteorological facilities that maintained adequate records of weather forecasts. More education on zero tillage, organic farming and better land management practices has to be provided by extension agents.

Benedicta *et al*. (2010) [5] reported that he looked at how farmers in Ghana saw and responded to climate change and they found that they gave varied explanations for the apparent rise in temperature. The perceived rise in temperature was attributed by about (63.30%) of farmers to deforestation, (18.90%) to bush burning, (3.30%) to rising population and (8.90%) to other factors, whereas (5.60%) of respondents were unable to provide any explanation.

Fagariba *et al.* (2018) [10] conducted a study on climate change adaptation strategies and challenges in northern Ghana and the results showed that respondents had a high level of challenges with adaptation due to unpredictable weather (36.00%), insufficient government support (35.33%) and poor weather information (30.66%), which came in first, second and third place, respectively.

Fawzy *et al*. (2020) [11] reflected a study on strategies for reducing climate change, which discovered that there were primarily three mitigation approaches. Conventional mitigation efforts used de-carbonization technologies and techniques that lower CO_2 emissions, such as renewable energy, fuel switching, efficient gains, nuclear power and carbon capture, storage and utilization. The second strategy comprised techniques that captured carbon dioxide from the atmosphere through negative emission, commonly referred to as carbon dioxide removal, such as improved weathering, ocean fertilization, soil carbon sequestration, afforestation and reforestation and the creation and restoration of wetland habitats. Thirdly, a strategy based on controlling solar and terrestrial radiation was proposed as a way to change the earth's radiation balance.

Methodology

The present study was conducted in Hisar district of Haryana state. The Hisar district was purposively selected for the investigation because of convenience, easy accessibility and familiarity with the area to the investigator. Out of nine blocks of Hisar district, two blocks were selected randomly for the present study. The study was conducted in Hisar-I block and Hisar-II block for the research problem. The present study was targeted the randomly selected four villages (two villages of each block) of Hisar district to meet out the above said objectives of present investigation. Two villages *i.e*. Kaimri and Mangali were selected randomly from block Hisar-I and two villages *i.e*. Neoli Kalan and Arya Nagar were selected randomly from block Hisar-II for the investigation. For the present study, a sample of 120 rural women was taken by random sampling method (30 women from each village) for the final data collection and implementation of the objective of the present study.

Results

Information related to farming of the respondents

In Table 1 an attempt was made to analyse the information related to farming of the respondents with respect to their size of land holding, type of land and farming experience (in yrs) as well as source of irrigation used by the respondents.

Size of land holding

It can be clear from the Table 1 that out of the total respondents, 23.33 per cent were landless. Majority of the size of the land holding respondents (45.83%) had marginal followed by small *i.e.*, 21.67 per cent category. Only 5.00 per cent respondents were having medium size of land holding and 4.17 per cent were having large size of land holding category.

Type of land

Regarding the type of land, majority of respondents (56.52%) were having fully irrigated type of land which was most suitable land for farming followed by semi-irrigated type of land *i.e*., 40.21% and 3.27 per cent were having dry type of land (Table 3).

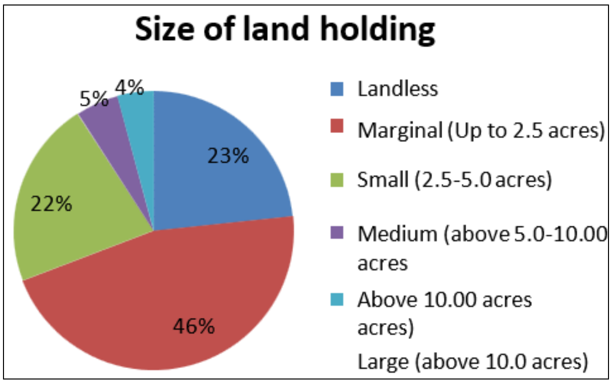

Fig 1: Size of land holding

Table 1: Information related to farming of the respondents

S. No.	Variables & categories	Frequency	Percentage
1.	**Size of land holding**		
	Landless	28	23.33
	Marginal (Up to 2.5 acres)	55	45.83
	Small (above 2.5-5.0 acres)	26	21.67
	Medium (above 5.0-10.0 acres)	06	05.00
	Large (above 10.0 acres)	05	04.17
2.	**Type of land**		
	Dry/Rainfed	03	03.27
	Semi-irrigated	37	40.21
	Fully irrigated	52	56.52
3.	**Farming experience (in yrs)**		
	1-5 yrs	07	07.61
	5-10 yrs	19	20.65
	10-15 yrs	31	33.69
	15-20 yrs	22	23.91
	> 20 yrs	13	14.13
4.	**Source of irrigation**		
	Borewell	13	14.13
	Canal	75	81.52
	Tank	04	04.35

Farming experience (in yrs)
On the basis of numbers of years completed in farming by the respondents, it was indicated from Table 1 that majority of the respondents (33.69%) were having farming experience in between 11-15 years followed by (23.91%) in between 16-20 years and (20.65%) in between 6-10 years of farming experience by respondents, while 14.13 per cent of the respondents were having farming experience of more than 20 years and only 7.61 per cent had the farming experience in between 1-5 years (Table 1).

Source of irrigation
With respect to source of irrigation, the majority of respondents *i.e.*, 81.52 per cent were using canal as their source of irrigation followed by borewell (14.13%) and only 4.35 per cent were using tanks as the source of irrigation in their fields (Table 1).

Crops grown and cropping pattern used by the respondents
The data presented in Table 2 revealed the various crops grown by the respondents and the cropping pattern used by the respondents in terms of frequency and percentage.

Table 2: Crops grown and cropping pattern used by the respondents

S. No.	Variables & Categories	Frequency	Percentage
1.	**Crops**		
	Wheat	92	100.00
	Barley	48	52.17
	Chickpea	21	22.83
	Mustard	81	88.04
	Fodder	92	100.00
	Vegetables	41	44.57
	Fruits	27	29.35
	Cotton	83	90.22
	Pearl millet	54	58.70
	Green gram	23	25.00
	Cluster bean	17	18.48
	Rice	07	07.16
2.	**Cropping pattern**		
	Mono cropping	04	04.35
	Multiple cropping	92	100.00

*Multiple response

Crops grown
On the basis of crops grown by the respondents Table 2 showed that cent per cent of the respondents were growing wheat and cent per cent respondents brought fodder as the food for animals followed by cotton (99.22%) and mustard (88.04%). Pearl millet was grown by the respondents (58.70%), barley (52.17%), vegetables (44.57%), fruits (29.35%), green gram (25.00%), chickpea (22.83%), cluster bean (18.48%) and only 7.16 per cent were growing rice in their respective fields.

Cropping pattern
Regarding cropping pattern used by the respondents, cent per cent respondents were followed multiple cropping pattern by growing different types of crops in their fields and only

4.35 per cent were used mono-cropping pattern to increase the fertility rate in their respective fields (Table 2).

Adaptation practices followed by rural women
The results indicates the adaptation practices adopted by the rural women to mitigate the adverse effect of climate change. The rural women adopted various adaptation practices according to the following sub-headings shown in Table 3 to Table 6.

- Adaptation practices followed by rural women for crop production
- Adaptation practices followed by rural women for energy and water resources
- Adaptation practices followed by rural women for animal husbandry
- Alternatives/option of income generation after natural calamities

Adaptation practices followed by rural women for crop production
It could be observed from Table 3 that majority of rural women have adopted contingent crop plan (61.66%) as adaptation practices followed crop diversification (54.16%), change in cropping pattern and planting schedule (49.16%)

and shifted from long duration to short duration of crop varieties (47.50%). The adaptation practices like adopted soil moisture conservation measures to conserve soil moisture (40.00%) followed by the use of recommended package of practice of crops (28.33%). Mixed farming (10.00%), organic and natural farming methods (5.83%), planting of trees (3.33%) and reduction of the cropped area (1.66%) were least preferred adaptation practice climate change by the rural women of selected villages.

Table 3: Adaptation practices followed by rural women for crop production N = 120

S. No.	Adaptation practices for crop production	Frequency	Percentage
1	Shifted from long duration to short duration of crop varieties	57	47.50
2	Reduction of the cropped area	02	01.66
3	Use of recommended package of practice of crops	34	28.33
4	Contingent crop plan	74	61.66
5	Adopted soil moisture conservation measures to conserve soil moisture	48	40.00
6	Change in cropping pattern and planting schedule	59	49.16
7	Crop diversification	65	54.16
8	Mixed farming	12	10.00
9	Organic and natural farming methods	07	05.83
10	Planting of trees	04	03.33

*Multiple response

Adaptation practices followed by rural women for energy and water resources

Regarding energy and water resources the rural women have adopted sowing/planting on ridges and furrows (56.66%) as adaptation practices followed by use of mulching (40.00%) and use of laser land levelling schedule while (28.33%) rural women adopted the use of solar and other energy sources followed by use of drip irrigation (18.33%) and cultivating varieties that required less water (8.33%). The adaptation practices like re-use of waste water (6.67%) and use of rain water harvesting (1.67%) were least preferred by the rural women as a adaptation practice. (Table 4)

Table 4: Adaptation practices followed by rural women for energy and water resources N =120

S. No.	Adaptation practices for energy and water resources	Frequency	Percentage
1	Sowing/planting on ridges and furrows	68	56.66
2	Cultivating varieties that required less water	10	08.33
3	Use of drip irrigation	22	18.33
4	Use of rain water harvesting	02	01.67
5	Re-use waste water	08	06.67
6	Use solar and other energy sources	25	20.83
7	Use of laser land levelling	34	28.33
8	Use of mulching	48	40.00

*Multiple response

Adaptation practices followed by rural women for animal husbandry

The data given in Table 5 represents that (86.66%) of the rural women were shifted the location of shed of their livestock followed by (81.66%) were provided proper care to livestock in case of any health issue and (76.66%) of the rural women had regulated the dung and urine management practices as a adoptive practice due to climate change. The rural women (71.66%) were handled the feed management of livestock for their wellbeing health and (64.16%) adopted the practice of preventive vaccination of their animals for increase their immunity.

Table 5: Adaptation practices followed by rural women for animal husbandry N = 120

S. No.	Adaptation practices for animal husbandry	Frequency	Percentage
1	Feed management	86	71.66
2	Dung and urine management practices	92	76.66
3	Preventive vaccination of animals	77	64.16
4	Shifted shed location of livestock	104	86.66
5	Provided proper care to livestock in case of health issue	98	81.66

*Multiple response

Alternatives/option of income generation after natural calamities

Table 6 shows the alternatives/option of income generation after natural calamities followed by the rural women. It was observed that majority of the rural women (30.00%) were worked at lower wages to generate income followed by 25.83 per cent family members find out other jobs after the damage of their crop production due to climate change and 10.00 per cent were those who migrated from their family outside the district for the purpose of work to generate income.

Table 6: Alternatives/option of income generation after natural calamities N = 120

S. No.	Statements	Frequency	Percentage
1	Find out other jobs	31	25.83
2	Migrated from family outside the district for work	12	10.00
3	Worked at lower wages to generate income	36	30.00

*Multiple response

Summary and conclusion

- More than half of the rural women had adopted contingent crop plan followed by some of rural women adopted crop diversification and almost half had changed in cropping pattern and planting schedule for the crop production due to climate change.
- Majority of the rural women (56.66%) had adapted the practices among energy and water resources were use of ridges and furrows while a sizable portion were adopted use of laser land leveling and less than half had adopted use of mulching to conserve soil moisture.
- More than majority of the rural women adopted the practice of shifting shed location of livestock, majority had provided proper care to livestock in case of health issue and more than half took care of preventive vaccination of animals.
- Some of the rural women (30.00%) used to worked at lower wages to generate income followed by (25.83%) whose family members find out other jobs after natural calamities and only (10.00%) were migrated from family for work outside the district, some alternatives of income generation after natural disasters.

The rural women mostly faced the constraints in adaptation of climate change was lack of knowledge regarding appropriate adaption strategies followed by lack of information about accurate weather forecast and lack of storage facility in the villages were top three ranked constraints with weighted mean score 2.40, 2.29 and 2.11, respectively

Discussion

The results shows that more than half of the rural women had adopted contingent crop plan followed by some of rural women adopted crop diversification and almost half had change in cropping pattern and planting schedule for the crop production due to climate change, the findings are in accordance with Rahman (2020) concluded production by a change in crop pattern and by crop diversification and the findings also matches with Wajih and Shiraz (2008) [20] reported the respondents had implemented a variety of climate change adaptation strategies, including crop intensification, diversification, value addition and crop cycle management. Almost of the rural women had adapt the practices among energy and water resources were ridges and furrows while a sizable portion had adopted laser land leveling and less than half had adopted mulching to conserve soil moisture, the results of the research study were in conformity with research findings of El-Beltagi *el al.* (2022) concluded that respondents to choose mulching rather than synthetic applications and also with Jamadar (2012) [13] reported that the majority of respondents had adopted adaptation strategies such as switching from long to short duration types of crops (92.00%), followed by adjustments in spacing (88.66%), irrigation ridges and furrows (33.00%), changes in planting date (23.33%) and mulching (10.00%). The results shows that the rural women had adopted the practice among animal husbandry was shifting shed location of livestock (86.66%), whereas majority had provide proper care to livestock in case of health issue (81.66%) and more than half take care of preventive vaccination of animal (64.16%). After natural calamities, some of the rural women (30.00%) used to work at lower wages to generate income followed by (25.83%) whose family members find out other jobs after natural calamities and only (10.00%) migrated from family outside the district for work. Regarding constraints in adaptation of climate change there was lack of knowledge regarding appropriate adaption strategies (WMS 2.40) followed by lack of information about accurate weather forecast (WMS 2.29) and lack of storage facility in villages (WMS 2.11) were top three ranked constraints. The results match with Pandey (2020) concluded that (75.70%) farm women faced constraints of limited knowledge regarding climate change and adaptation measures.

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