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Aishwarya Tiwari
Department of Agricultural Extension, CoA, IGKV, Raipur, Chhattisgarh, India

Dr. RS Sengar
Professor, Department of Agricultural Extension, CoA, IGKV, Raipur, Chhattisgarh, India

Akanksha Minj
Department of Agricultural Extension, CoA, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Aishwarya Tiwari
Department of Agricultural Extension, CoA, IGKV, Raipur, Chhattisgarh, India

Coping mechanism adopted by the farm women against the climate change with reference to rice crop

Aishwarya Tiwari, Dr. RS Sengar and Akanksha Minj

Abstract
The study was conducted in Bilaspur district, consisting of four blocks: Kota, Takhatpur, Bilha, and Masturi. 120 farmwomen were randomly selected from three villages, and an interview schedule were designed to collect data. Farm women in the study area delayed sowing dates for paddy rice due to excessive rainfall. Lehi sowing were choosen by 95.8% of farmers, while harvesting rice on bunds for drying were choosen by 89.1%. Over 75% of farmers used late harvesting, double sowing, turning harvested rice multiple times for drying, and delaying sowing.
Farm women also offered additional coping strategies, such as filling up gaps, growing more seedlings, creating channels, increasing broadcast sowing, and increasing seed rate. The majority of farm women used broadcasting methods of sowing to reduce crop failure risk. They also used short-duration crops, replanting or planting seedlings, making ditches, changing crop varieties, spraying foliar and reapplied urea, and changing planting timing. Insect and disease- resistant varieties were adopted, and routine field visits were the main methods for coping with cloudy weather.

Keywords: Farm women, coping mechanism, majority, seedling, rice, excessive rainfall, sowing, varieties etc.

Introduction
Agriculture is an essential component of the well-being of society. It covers 40% of the earth's surface, consumes 70% of the world's water resources and manages biodiversity at genetic, species and ecosystem levels since 1950, high-yielding crop varieties, extensive use of inorganic fertilizers and pesticides, expansion of irrigation facilities, and capital-intensive farm management have resulted in unprecedented growth in agricultural productivity. Thus, climate change and agriculture are interdependent processes, both occurring on a global scale. Even small shifts in climate change can have major effects on agricultural productivity. Current differences in crop productivity and yield between different regions are likely to increase as farmers feel the effects of climate change. According to the Intergovernmental Panel on Evolution (IPCC, 2009) [4], rising temperatures, droughts, floods, desertification and extreme weather events will seriously affect agriculture, especially in developing countries. Meanwhile, agriculture accounted for 13% of total greenhouse gas emissions in 2000. In developing countries, these emissions are expected to increase over the coming decades due to factors such as population growth and income. In agriculture, fertilization, animal husbandry and manure management, rice cultivation and savannah burning are the main sources of emissions Significant global climate change will affect agriculture and, by extension, the global food supply Climate change itself is not necessarily harmful; these problems are caused by unpredictable extreme events (FAO 2001) [2] More erratic rainfall patterns and unpredictable heat will reduce crop productivity accordingly. Developing countries in the tropics are particularly vulnerable Latitude and elevation changes in ecological and agro-economic zones, land degradation, extreme geophysical events, reductions in water availability, sea level rise and salinization are assumed (FAO 2004) [3] Many studies have investigated the effect of increased temperature on the productivity of crops such as wheat and rice. Sinha and Swaminathan (1991) [9] observed that a 2 °C increase in temperature could increase rice yield by about 0.75 ton/ha in high yielding areas. A decrease and an increase in winter temperature of 0.5 ºC would reduce wheat yield by 0.45 ton/ha. And Kalra *et al*. (2003) [5] estimated that a 2 °C increase in average temperature would reduce rice yield by about 0.75 t/ha in high yielding areas and by about 0.06 ton/ha in low yielding areas, low-yielding coastal areas. Rao and Shina (1994) [7] reported that wheat yield could decrease by 28-68% if the effects of CO2 fertilization were not taken into account.

Saseendran *et al*. (2000) [8] reported that every degree of temperature increase reduced rice yield by about 6%.

At the same time, horticultural crops are more sensitive to changing conditions than arable land, and vegetables in particular are affected by temperature changes Water scarcity directly affects fruit and vegetable production (Zarin, 2007) [10] Frequent and prolonged droughts and heavy rains, leading to flash floods, are predicted by climate change modelers for different parts of the world. Severe drought conditions predicted for the next few decades will affect the nutritional status of soils. Drought reduces the uptake of nutrients such as P and K by plants. In soils where P is already low, this will cause additional stress on plants and ecosystems, since P and K require high water use efficiency and stomatal control. To counter the agricultural production of these opponents, there is an urgent need to quantify the biomass production and harvest indices of important crops and to develop appropriate land use scenarios to maintain agricultural productivity There is a need to develop biophysical and socio-economic data based on agro-ecological regions, using facilities available on various research farms, to assess the global impact of climate change Changes in precipitation patterns will affect land surface temperature and moisture availability This will affect crop establishment, the maturity period of crop stands and overall crop production Climate change will impact land degradation, leading to waterlogging, salinization and alkalization of soils in vulnerable regions of the world Seasonal climate variability (mainly temperature and rainfall) affects agricultural production and food security The net balance after accounting for production gains and losses due to climate change shows a negative trend in production growth.

Agriculture in India is the most significant component of the country's economy, and it is slowly starting to suffer from climate change. With monsoons becoming unpredictable and rainfall becoming sparse, rain-fed agriculture systems are suffering greatly. Around 80% of the rural population in Chhattisgarh, a state in central India, is employed in the agricultural industry, which also contributes 16% of the state's Gross Domestic Product (GDP). The bulk of these marginal farmers, or around 46% of the total 80 percent, depend on rain-fed mono- crop agriculture, rendering them particularly sensitive to the effects of climate change. Due to their hilly areas, Chhattisgarh's northern and southern regions in particular lack adequate irrigation infrastructure. Additionally, the State Action Plan on Climate Change indicates that without any remaining soil moisture, roughly half of the arable land is left fallow for any second crop, which makes things much more challenging for farmers.

According to recent studies on climate change in Chhattisgarh, the pattern of rainfall changed during the 20th century, there were variations in the onset and offset of the monsoon, many districts experienced a decrease in rainfall, and the number of years with a deficit of rainfall rose during the global worming period. Numerous studies have demonstrated that the state's climate is warming due to an upward tendency in both the maximum and minimum temperatures. Farmers in the state are susceptible due to the climatic fluctuation because agriculture is the only source of their income. A very slight change in the climate can have a significant direct and indirect impact on the people and their way of life. Compared to hilly regions, the effects of climate change are less obvious in the plains, but there are undoubtedly some possible effects that are still unknown and could have a negative impact on the plains regions as well. As a significant producer of rice, Chhattisgarh is primarily reliant on monsoon rainfall because the area has only a very tiny area of irrigation facilities. The availability of water for home use, the storage of water in dams, the level of groundwater, the production of hydroelectricity, the planning of government policies and programmes, etc. are all reliant on monsoon rains. According to recent studies on climate change in Chhattisgarh, the pattern of rainfall changed during the 20th century, there were variations in the onset and offset of the monsoon, many districts experienced a decrease in rainfall, and the number of years with a deficit of rainfall rose during the global worming period. Several studies have shown that the state's climate is warming up as a result of an upward tendency in maximum and minimum temperatures. Farmers in the state are susceptible due to the climatic fluctuation because agriculture is the only source of their income.

Material and Methods

The study was carried out in the Bilaspur district, which comprises with four blocks *viz*. Kota, Takhatpur, Bilha, and Masturi, all the four blocks were selected for this study. Three villages were selected randomly from each block. (3*4=12) From each village, 10 farmwomen were selected randomly, total of 120 farmwomen considered as respondents.

An interview schedule were designed for the study based on the objectives, the data were collected. The schedule were formulated for this study. The pre-testing were taken into account while changing the schedule layout, question structure, and order. The interview schedule were created in the local language so that participants in the study could reply to it with easy.

Results and Discussion

The ability of farmers to react and adjust to real or projected effects of changing climate conditions on crop in ways that cause only minor harm or take advantage of any favorable chances that the climate may give is known as their coping mechanism. It also focuses on enhancing adaptive capacity while reducing projected negative effects of climatic unpredictability and extremes. The activities made locally by the farm women themselves in response to shifting market or environmental conditions should be included. Learning about risks, assessing available responses, establishing conditions that facilitate adaptation, mobilizing resources, putting adaptations into practice, and changing decisions in light of new information are all parts of the adaptation process.

According to the research, farm women coping mechanisms to deal with the negative effects of climate change on paddy production may be divided into four categories: crop management, soil fertility, land preparation, and farm size or crop diversification.

Additionally, we gathered information from the farm women, looked into real farm-level coping mechanisms, and documented how rice farm women deal with extreme conditions brought on by excess, shortfall, or no rainfall during different phases of crop. The details of the particular techniques included in each of these tactics are provided below.

Table 1: Distribution of the respondents according to their Coping mechanism in rice crop against excess rainfall. (n=120)

Sl. No.	Coping mechanism	Frequency	Percentage
1.	Delay sowing	84	70
2.	Double sowing	92	76.7
3.	Use short duration varieties	101	84.1
4.	Sowing by lehi method	115	95.8
5.	Increase broadcasting method of sowing	43	35.8
6.	Grow more seedling than required	58	48.3
7.	Increase seed rate	37	30.8
8.	Gap filling	63	52.5
9.	Prepare channels inside the field to drain excess water	46	38.3
10.	Late harvesting	98	81.7
11.	Keep harvested rice on bunds for drying	107	89.1
12.	Turn several times harvested rice for drying(Karpa palatna)	91	75.8

Lehi sowing method was choosen by the majority of farm women (95.8%) in cases of excessive rainfall, farm women were coping strategy for rice against excessive rainfall, i.e delay sowing 90% of the farm women in the study area adopted this modification in planting date, while farm women kept harvested rice on bunds for drying (89.1%), followed by short- duration varieties (84.1%).

When crops were mature, the majority of farmers (81.7%) choose late harvesting. This was followed by double sowing (76.7%), turning harvested rice several times for drying (Karpa palatna) (75.8%), and delaying sowing was choosen (70%) as main strategies to deal with excess rainfall at various stages of the cropping season, respectively.

Some of the farm women offered additional coping strategies to deal with the excessive rains, which, if successful, may be advantageous for the entire farming community. Farm women were quite likely to filled up gaps (52.5%), grown more seedlings than necessary (48.3%), Farm women were creating channels inside in the field to drain excess water (38.3%), Used broadcast sowing method (35.8%), and were increased seed rate, at the time of excess rainfall. Parganiha Omprakash (2016) [6] has revealed the similar findings.

The variance in how these techniques were adopted makes it obvious that they need to examine the efficacy of their efforts and the resources they have on hand to deal with these circumstances.

Table 2: Distribution respondents according to their coping mechanism against deficit rainfall. (n=120)

Sl. No.	Coping mechanism	Frequency	Percentage
1.	Delay sowing	84	70
2.	Sowing of drought resistant variety	73	60.8
3.	Direct seeded rice	102	85
4.	Increase seed rate	36	30
5.	Transplanting in early age seedlings	57	47.5
6.	Use of short duration varieties	104	86.6
7.	Adopt broadcasting method of sowing	117	97.5
8.	Use of line sowing method	75	62.5
9.	Application of FYM to increase water holding capacity	111	92.5
10.	Delayed biasi	65	54.1
11.	Take crop insurance scheme	45	37.5
12.	Late harvesting	98	81.6

If there is no rain during crop planting, the soil becomes dry and difficult to work, which affects the sowing of seeds and their germination. Even a few weeks delay in the beginning of rain and protracted dry spells between the various stages of agricultural production were found to have a substantial impact on the yield.

The actual coping mechanisms employed by farm women to deal with rainfall shortfalls at various stages of paddy production are listed in Table 4.17. 92.5%, 86.6%, and 85% of farm women were using short-duration varieties, direct seeded rice, and higher usage of FYM to increase water-holding capacity respectively.

The majority of farm women (97.5%) use the broadcasting method of sowing and 30% farm women increased seed rate respectively. The main coping mechanisms employed by the respondents in the research area to lessen the risk of crop failure were late harvesting (81.6%), delayed sowing (70%), the use of line sowing method (62.5%), and seeding for drought resistant varieties (60.0%). However, delayed biasi (54.1%) of farm women used transplanting when seedlings were young (47.5%), crop insurance (37.5%) and increased seed rate (30%), respectively.

Table 3: Distribution respondents according to their coping mechanism against high temperature. (n=120)

Sl. No.	Coping mechanism	Frequency	Percentage
1.	Early sowing of rice	102	85
2.	Adjustment of site-specific cropping	87	72.5
3.	Adopt late or early maturing cultivars to escape high temperature during grain filling	99	82.5
4.	Mulching practices	79	65.8

Table 3 shows that the majority of farm women (85%) sow rice early, while 82.5%, 72.5%, and 65.8% of farm women, choose late or early maturing cultivars to avoid high temperatures during grain filling, adjust site-specific cropping, and mulching practices, respectively.

Table 4: Distribution respondents according to their coping mechanism against damaging of standing crop. (n=120)

Sl. No.	Coping mechanism	Frequency	Percentage
1.	Make ditches to direct water	88	73.3
2.	Change crop varieties	67	55.8
3.	Change timing of planting	45	37.5
4.	Use short duration crop	106	88.3
5.	Replant or plant seedling again	90	75
6.	Spray foliar and reapplied urea	55	45.8

Table 4, demonstrates that the majority of farm women (88.3%) used short-duration crops, replanting or planting seedlings again (75%), making ditches to direct water (73.3%), changing crop varieties (55.8%), spraying foliar and reapplied urea (45.8%), and changing timing of planting (37.5%) as coping strategies against damaging of standing crop.

Table 5: Distribution respondents according to their coping mechanism against cloudy weather. (n=120)

Sl. No.	Coping mechanism	Frequency	Percentage
1.	Regular field visit to see the insect and disease	59	49.1
2.	Adoption of insect and disease resistance varieties	68	56.6

According to Table 5, shows that the use of insect and disease resistant varieties, the 56.6 percent farm women were using resistant rice varieties followed by routine field visit were the insect and disease 49.1 percent farm women in cloudy weather.

Conclusion

The majority of farm women in the study area delayed in sowing dates for rice due to excessive rainfall. Lehi sowing were choosen by the majority of farm women (95.8%), while harvesting rice kept on bunds for drying were chosen by 89.1%. When crops were mature, the majority of farmers (81.7%) choosen late harvesting, followed by double sowing (76.7%), turning harvested rice several times for drying (Karpa palatna) (75.8%), and delayed sowing (70%) as main strategies to deal with excess rainfall.

Additional coping strategies were offered by farm women, such as filled up gaps (52.5%), grown more seedlings than necessary (48.3%), created channels inside the field to drain excess water (38.3%), used broadcast sowing method (35.8%), and increased seed rate. The majority of farm women (97.5%) used the broadcasting method of sowing. The main coping mechanisms employed by respondents to lessen the risk of crop failure were late harvesting (81.6%), delayed sowing (70%),used line sowing method (62.5%), and used for drought- resistant varieties (60.0%). However, 54.1% of farm women used transplanting when seedlings were young (47.5%), crop insured (37.5%), delayed biasi (54.1%), and increased seed rate (30%).

The majority of farm women (85%) sown rice early, while 82.5%, 72.5%, and 65.8% choose late or early maturing cultivars to avoid high temperatures during grain filling, adjusted site-specific cropping, and used mulching practice. The majority of farm women (88.3%) used short-duration crops, replanted seedlings again (75%), made ditches to direct water (73.3%), changed crop varieties (55.8%), sprayed foliar and reapplied urea (45.8%), and changed planting timing (37.5%) as coping strategies against damaging standing rice crops. According to the results, 56.6 percent of farm women were employing rice varieties that were resistant to insects and diseases, followed by frequent visited by farm women in their fields who were 49.1 percent adopted resistant to insects and diseases rice varieties.

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