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Climate Perceptions and Access to Information Among Spice Farmers in Idukki District of Kerala

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ABSTRACT

Agricultural sector is a significant component of the rural livelihoods and food security in India. Climate variability and change is increasingly affecting the agricultural outcomes in the country. Farmer's perceptions and information on weather change is an important determinant of making adequate responses to this challenge. The main objective of this paper is to examine the nature and sources of weather information gathered by farmers. It is also necessary to understand the differences in farmer's perceptions on long term changes in weather, and trends observed in actual weather station data. This study is undertaken in a Spice farming community of Idukki district in Kerala. The study finds considerable differences in farmer's perceptions and weather station data. The results indicate the use of both conventional and modern sources of weather information among farmers. Although, there are substantial socio-economic disparities deciding the access to weather information within the community. The study suggests the need for providing more timely and reliable weather information to farmers in regional scales.

Keywords: Climate change; Weather information; Agriculture; Spices

INTRODUCTION

Agriculture is a major source of livelihood and is fundamental for food security especially for developing countries. For India, although the share of agriculture in national income is declining over the years (<15% in 2010-11 from 37% in 1970-71), the sector remains as a significant component in terms of food security, rural employment, and poverty alleviation (Birthal *et al.*,2014). Despite this importance, the sector largely remains rainfed and is dominated by small holders. Climate variability and change is an important challenge in this context which is significantly affecting agricultural productivity in the country (Morton, 2007; Mertz, 2009). In this context, perceptions of weather change among farmers and the access to weather information to counter such impacts are important. Farmer's perceptions about weather change are a fundamental part of forming responses against it. In addition to their own experiences and perceptions, farmers also make communications on weather changes with their peer farmers or family. Although lack of timely and accurate information may lead to ineffective responses against weather. How farmers perceive weather can be different from the weather station data. To what extent farmer's perception matches with weather station data, thus underlines the need for better weather information.

Weather information can be viewed as an everyday decision-making tool against various types of risk. It can optimize different aspects of production including timing of planting or harvesting, extent of irrigation, usage of fertilizers and pesticides and, changes in cropping pattern. These adjustments can result in better production, reduction in costs and more resilience to climate related stress. Over the years, many governments and civil societies have acknowledged the need for effective weather information in agriculture. There has been attempts to make meteorological data more accessible and disseminate it in regional levels. There are still constraints in reaching this information to the farmers and enabling them in better decision making. Thus, this study tries to map the farmer's perception on weather and the accessibility of weather information in the community. The study is undertaken in a Spice farming community of Idukki district in Kerala. Given the lucrative and commercial nature of Spice cultivation, information plays an important role in farm level decision making. This makes it an important case for the current study.

LITERATURE REVIEW

Many studies have looked at the importance of weather information in agriculture (Hellmuth *et al*., 2005; Patt *et al*., 2005;Fafchamps & Minten, 2012; Yegbemey *et al*., 2014; Mittal *et al*., 2018). Camacho & Conover (2019) conducted a randomised controlled trial experiment on small farmers in rural Colombia. A group of farmers received text messages on prices and weather forecasts. Farmers who received the messages were found to be making changes in their farming interventions. Mugerwa *et al*., (2014) finds that some farmers identify conventional weather forecasts as unreliable and only provides a broader understanding. Limited knowledge to predict weather based on conventional ways have led to less resilience in the face of issues like drought. Many farmers regard informal contacts with peer farmers and private input suppliers as the major source of information in addition to their own perceptions. Trust and timing are two important components of weather information (Kumar *et al.*,2020).

Caine *et al.*,(2015) specified the increasing importance of information and communication technologies like Mobile phones for weather information. Use of visual and participatory applications and videos on mobile devices will be highly helpful for farmers. In addition to providing information, increase in mobile data collection and devising farmer friendly tools is important. Batte *et al*., (1990) points out the difference in information sources between large and small farmers. Large farmers preferred marketing consultants, commercial newsletters, and cooperative information services. Age and farm size are also shown as important in deciding information access. Gbangou *et al*.,(2020) indicates that jointly producing climate information with the involvement of both farmers and scientific community is crucial. There should be continuous activities such as training, monitoring, and technical support.

Mittal (2016) finds that information through mobile phones have reduced information asymmetry among the farming community. Especially the gender differences in access to information has been narrowed down due to mobile phones. Pandey & Singh (2020) through a study in Uttar Pradesh finds that access to better information has resulted in effective spatial arbitrage and crop grading

in the study region. Das et al. (2016) also gives insights into the importance of mobile phones, voice mails and SMS solutions for weather related issues in farming. A voice messaging system in local language was found to be effective in West Bengal. Wamalwa *et al*.,(2016) studies the importance of agro-climatic information in the adoption of climate smart practices among small farmers in the context of Kisii county in Kenya. Overall, this interaction is reported to be low among small scale farmers. This is a challenge in devising climate smart policies in agriculture.

OBJECTIVES

To examine the long-term changes in key weather variables in the region through meteorological data from weather stations

To compare the farmer's perceptions on weather changes and the weather station data

To assess the sources of weather information accessed by farmers and the factors determining it

To examine the barriers in weather information access as reported by the farmers

MATERIALS AND METHODS

The study area is the Idukki district of Kerala which is the largest district in the state. The district is situated between 9°51'0"N latitude and 76°58'0.01"E longitude. The district is known for its significant involvement in Spice farming. Nearly 90 percent of the district's area comprises of high ranges shielded by mountains, hills, and deep valleys. Also. more than fifty percent of district's area is covered by forest with unique agro-climatic pattern making it suitable for the cultivation of Spices. A sample of 20 farmers each were purposively collected from six Gram Panchayats in the Idukki district. The present study uses a mix of primary and secondary data sources, for understanding the incidence of weather changes and the access of weather information by farmers in the region. Primary data about farmer's perceptions of weather and access to weather information were collected through a survey. The data was collected through a structured questionnaire from a total of 120 farmers. The data was collected on socio-economic and demographic details of the farmers, perceptions on weather change, major sources of weather information, and the barriers in getting information. For primary data analysis statistical measures such as frequency and percentage, arithmetic mean, ranking, and correlations were used.

Secondary data was used to understand the changes in key weather variables for the study region over time. Estimation of long-term changes in weather variables were undertaken through a trend analysis of climate data from 1990 to 2020. The annual data on precipitation, relative humidity, temperature and wind speed were retrieved from NASA POWER (The Prediction of Worldwide Energy Resources data set, retrieved from; https://power.larc. nasa. gov/) for Idukki district. Mann-Kendall test and Sen's slope estimator are used to understand the actual trend of weather data and to detect the direction of change in this paper.

Mann-Kendall is a non-parametric test performed to detect the trends in time-series data.The Mann–Kendall statistic (Mann 1945; Kendall 1975) is calculated as:

$$S = \sum_{i-1}^{n-1} \sum_{j=i+1}^{n} sgn(X_j - X_i)$$

Where n is the number of data points, X_i and X_j are the annual data values in the years i and j (j>i), respectively,

Mann-Kendall statistic (S), were calculated for each weather variable. If, p-value of S-statistic is less than 0.01, then there is a significant trend in the weather variables over time at 1% level of significance. When the sign of S statistic is positive, it denotes an increasing trend. The negative sign denotes a decreasing trend. In addition, Sen's slope estimators are also calculated to understand the slope of the weather variables. Sen's slope graphs are also given, where a negative slope denotes a declining trend and a positive value indicates and increasing trend. XLSTAT trial version and STATA 15 statistical software were used for the data analysis.

RESULTS AND DISCUSSION

1. To Examine the Long-term Changes in Key Weather Variables in the Study Region Through Weather Station Data

The study used yearly data on precipitation, relative humidity, temperature, and wind speed to understand the nature of changes in long term climate in Idukki district. The summary statistics of major climatic variables indicate some characteristics of the climate in Idukki district and is reported in Table1.

Table1: Summary Statistics of Major Climate Variables in Idukki District (1990-2020)

Climate Variable	Minimum	Maximum	Mean	SD
Precipitation (millimetres)	1286.720	2636.720	1938.925	339.435
Relative humidity(Percent)	14.280	15.500	14.969	0.311
Temperature(Celsius)	20.700	25.520	23.493	1.302
Wind speed (meter/second)	0.380	0.470	0.426	0.024

Mean precipitation level is 1938.92 mm and the summary of the data shows considerable variations from the mean. Precipitation in the region is thus showing substantial variations ranging from a minimum value of 1286.720 to a maximum value of 2636.720mm. The average relative humidity is around 14.96. Annual temperature is ranging from 20.7C to 25.5 C with a mean temperature of 23.4C. Although the values are not showing much fluctuation like precipitation, optimal temperature ranges are significant for climate sensitive spice crops like Pepper and Cardamom. Wind speed is also not showing much fluctuations in the data, ranging from a minimum of 0.380m/s to a maximum of 0.470m/s. In order to understand the long-term changes in weather patterns of the region, a trend analysis using Mann Kendall test and Sen's slope are conducted.

Results of trend analysis using Mann-Kendall test along with the p value and Sen's slope graphs indicating the magnitude of the trends are presented in Table 2. Except precipitation, all three other variables indicate significant trend. Although the summary statistics indicated anomalies in the precipitation data, there are no long-term significant trends in the data. Relative humidity is showing an increasing trend over the years. Average temperature and wind speed are indicating decreasing trends

Table2: Results of Mann-Kendall and Sen's slope Analysis

Climate Variable	Mann-Kendall Statistic (S)	p-value	Sen's slope	Observed trend
Precipitation	13	0.838	1.688	No significant trend
Relative humidity	228***	0.000	0.025	Increasing
Temperature	-161***	0.007	-0.079	Decreasing
Wind speed	-259***	0.0001	-0.002	Decreasing

(***Significant at 1%)

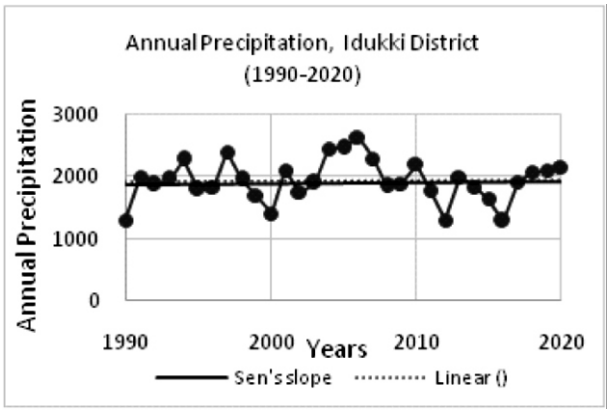

Figure 1: Sen's slope analysis of Annual Precipitation, Idukki District, (1990-2020)

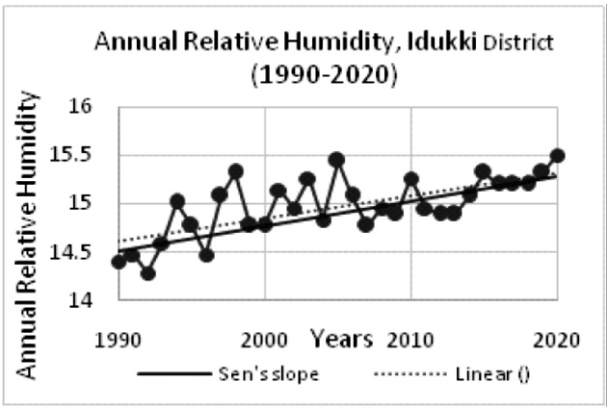

Figure 2: Sen's slope analysis of Annual Relative Humidity, Idukki District, (1990-2020)

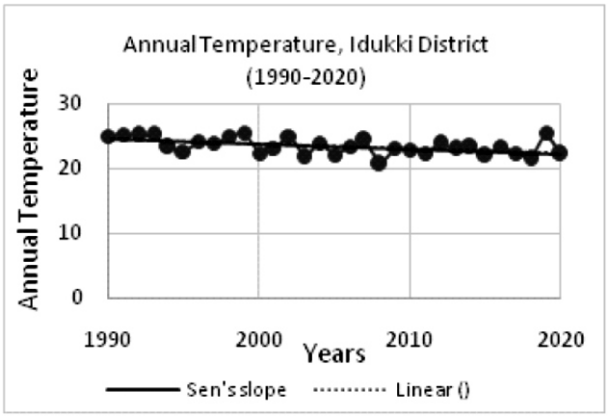

Figure 3: Sen's slope analysis of Annual Temperature

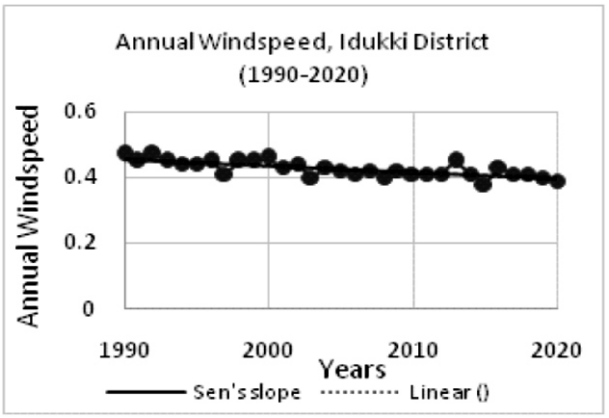

Figure 4: Sen's slope analysis of Annual Temperature, Idukki District, (1990-2020)

2. To Understand the Perceptions of Farmers on Weather Change and Compare it with Weather Station Data

The trend analysis test in the last section indicates significant variation in relative humidity, temperature and windspeed. This section presents the results from the field survey on how farmers in the study region are perceiving long term changes in weather. Tabe 3 presents percentage analysis of farmers perception of two major weather variables, rainfall, and temperature.

Table 3: Comparison of farmer's perception with weather data

Weather Variables	Farmer's perception	General trends from weather data	Major impacts on Spice crops
Rainfall	Increase= 57.50% Decrease=23.33% No change= 19.17%	Increasing	-Changes in seasonal flowering habitat -High pest and disease incidence -Loss of soil minerals
Temperature	Increase= 88.33 % Decrease=3.40% No change=7.50%	Decreasing	-Changes in water availability -Drying of plants -Delayed ripening of fruit capsules

(Source; Authors calculation from survey data)

Rainfall trends observed by farmers indicate mixed changes. 57.50% of the farmers report an increase in rainfall over time in the region. 23.33 % indicate decrease and 19.17% indicate no change. This mixed perception might also be due to that fact that intensity of extreme rainfall events and floods has increased in the recent years. Singh (2018) observes that farmer's perception about gradual changes such as rainfall patterns may overlap with more intrinsically noticeable phenomenon such as extreme rainfalls. Earlier the region used to have a consistent rainfall pattern in a moderate intensity, although now it is deficit rainfall in some months followed by heavy spell of rain in others. Temperature as observed by farmers is mostly increasing over time and 88.33 per cent of farmers report an increase. Since most of the farmers in the study region cultivates Spice crop like Pepper and Cardamom, mean optimal temperature range is highly significant. Any changes exceeding such limits will be difficult for the farmers since these crops are traditionally rainfed. Some farmers indicate recurring crop loss due to strong winds, which has become a routine event in the region now. Issues like wind-driven flower and fruit shedding, damage in the roots and acceleration of drying of the plants due to hot winds are commonly observed.The results compared with weather station trends show there is significant differences in official weather data and how farmers understand weather changes. This underlines the importance of bringing reliable weather information to the farming communities. It will help in real time decision making and better susceptibility to issues like climate change.

3. To Assess the Farmer's Choice of Weather Information Source and the Factors Determining It

The percentage analysis of farmer's access to weather information shows the active use of several sources among the community. The major sources of weather information as reported by the farmers are newspaper and magazines, radio and television, mobile phones and internet, peer farmers, and government sources. Table 3 depicts the percentage analysis of various sources of weather information.

Table 4: Farmer's Choice of Weather Information Sources

Sources of Weather Information	Percentage of Farmers
Newspapers and magazines	59.17 %
Radio and television	62.50 %
Mobile phones and internet	35.83 %
Peer farmers	68.33 %
Government sources	8.33 %

(Source: Author's calculation from the survey data)

Most relied source of weather information according to the farmers are getting information through peer farmers (68.33 %). Farmers are also dependent on media sources such as Radio and television (62.50 %) and Newspapers and magazines (59.17 %). Increasing digitalization has led to the use of mobile phones and internet (35.83 %) among the farmers for getting weather information. Only 8.33% of farmers access government sources for weather information. Given this, next section estimates the major determinants of preferred source of weather information among the farmers. Table 5 depicts the summary statistics of major socio-economic and demographic characteristics of sample farmers.

Table 5: Summary statistics of socio-economic and demographic variables of the farm households

Variable	Mean	Std. Dev	Min	Max
Land Size (In acres)	3.301583	3.252177	.1	25
Age of the respondent (In years)	50.175	12.0431	26	76
Education of the respondent (In years)	10.35833	3.444142	0	17
Monthly household expenditure	10420.83	5158.006	1000	40000
Gender of the respondent	1.116667	.3223687	1	2
Household has non-farm income	.4666667	.5009794	0	1
Membership in Farm groups	.425	.4964157	0	1

(Source; Authors calculation from survey data)

The sample is a mix of marginal, small and large farmers ranging from 10 cent to 25 acres of landholding, since Spice crops are cultivated as both small holdings and as large plantations. The mean age of respondent's are around 50 years. Education level of respondents in years ranges from 0 to 17. The mean monthly household expenditure is Rs.10,420. Only 11.67% of the respondents are females and rest are male. Around 46% of the farmers also have non-farm income sources. About 42% of the farmers are members in farm groups. Using the above variables, the determinants of sources of adaptation information is examined. The results of correlation analysis between socio-economic and demographic variables and each source of adaptation are presented in Table 6. The results indicate a significant role of these variable in determining the farmer's choice of weather information.

Access to other farmers for weather information is correlated with gender of the respondent and monthly household expenditure. Female headed household may have less networks, resulting in low access to other farmers for information.

Table 6: Correlation analysis of sources of weather information and socio-economic variables

Variables	Other farmers	Newspapers and farm magazines	Radio and television	Mobile phones and internet	Government sources
Land Size (In acres)	0.1428	0.3192***	0.2216**	0.3347***	0.2641**
	(0.1198)	(0.0004)	(0.0150)	(0.0002)	(0.0036)
Gender of the	-0.3649***	-0.1201	0.1201	-0.2704***	-0.1091
respondent	(0.0001)	(0.1914)	(0.1912)	(0.0028)	(0.2355)
Age of the	0.0441	-0.2132**	-0.3389 ***	-0.3125 ***	-0.1321
respondent (In years)	(0.6324)	(0.0194)	(0.0002)	(0.0005)	(0.1505)
Education of the	-0.1060	0.3719***	0.4404 ***	0.4218***	0.1350
respondent (In years)	(0.2491)	(0.0001)	(0.0001)	(0.0001)	(0.1416)
Monthly household	0.1979 **	0.2371 ***	0.1349	0.2355***	0.0689
expenditure	(0.0302)	(0.0091)	(0.1417)	(0.0096)	(0.4544)
Household has	-0.1328	-0.1681	-0.3248**	-0.3901	0.0455
non-farm income	(0.4334)	(0.2683)	(0.0371)	(0.0080)	(1.0000)
Membership in	0.2488	0.3689**	0.4486***	0.7361***	0.3711*
Farm groups	(0.1152)	(0.0144)	(0.0023)	(0.0000)	(0.0949)

[Significant at 1%***, 5%**, 10%*] (Source; Authors calculation from survey data)

Similarly, low-income households may have more community interaction or more reliance on traditional sources of information. In the case of access to newspapers and farm magazines, higher land size, education, monthly expenditure, and membership in farm groups are important factors. Also, young respondents are more probable to undertake information through Newspaper and magazines. Above mentioned factors also contribute to the access to Radio and television for weather information. In addition, household has non-farm income is negatively correlated with access to radio and television. All variables except household have non-farm income is correlated to the use of mobile phones and internet for weather information. Access to government sources for information is influenced by only land size and membership in farm groups.

4. To examine the barriers in weather information access as reported by the farmers

The major barriers in getting of weather information is reported by farmers and is summarized below in table 7;

The results indicate limited information sources as the highest barrier to get reliable climate information. It is followed by additional cost. Farmers also report limited accessibility to weather data sources as an issue. Lack of adequate schemes followed

Table 7: Barriers in accessing weather information as reported by farmers

	Percentage	Rank
Limited Accessibility	52.50	III
Limited information sources	78.33	I
Low responses	30.83	V
Lack of adequate schemes	35.9	IV
Additional cost	72.50	II

(Source; Authors calculation from survey data)

by low responses are other barriers.

CONCLUSION

In conclusion weather changes indicate an important issue in the study region and among spice farmers. Farmer's perceptions about weather change and trends observed through weather station data are slightly different with one another. This difference points out the need for more effective and reliable weather information in the region. Thus, the study has examined the importance of access to weather information in the farming community. The results indicate the use of both conventional sources like peer interaction and modern sources such as internet and mobile phones to gather information on weather. Estimations on the major determinants of these sources indicate many disparities within the community. The study suggests the need for providing more timely and reliable weather information to farmers in regional scales.

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Effectiveness of Embroidery Training in Developing Skills among Adolescent Girls

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ABSTRACT

The present study was an endeavor to develop skills in embroidery among rural girls. Four trainings of two days duration each on basic embroidery was organized for rural girls of four villages of Banaskantha district. Total 160 rural girls participated in these training programs. Five basic stitches of embroidery namely Herringbone stitch, chain, stitch, stem stitch, lazy daisy stitch and buttonhole were taught to the girls. The pre and post test research design was used to check the effectiveness of training programmes. Interview technique was used for collecting data. Data was analyzed by using frequency, percentage, mean and t-test. Findings show that training on embroidery was very effective in terms of knowledge enhancement and skill development of the respondents regarding embroidery.

Key words : Embroidery, Knowledge, Skill, Training, Girls

INTRODUCTION

India is the land of rich culture and diverse traditions. Almost every region of India has a distinct style of embroidery based on cultural history of the region. The ethnic hand embroidery is no longer the choice of occupation for the poor Indian artisans alone but is the weakness of the elite both in India and foreign markets. Embroidery is the handicraft of decorating fabric or other materials with needle and thread or yarn. Embroidery may also incorporate other materials such as, pearls, beads, quills, and sequins. Today, embroidery is most often seen on caps, hats, coats, blankets, dress shirts, denim, stockings, and golf shirts. Embroidery is available with a wide variety of thread or yarn color. The basic techniques or stitches on surviving examples of the earliest embroidery chain stitch, buttonhole or blanket stitch, running stitch, satin stitch, cross stitch remain the fundamental techniques of hand embroidery today.

India is still a virgin market for embroideries. Traditionally, embroidery is used for ornamentation of apparel and other products. This a form of embellishment is now getting popular in menswear. There is a huge potential of embroidery in the country, which is still to be tapped. It can be a good avenue for rural women to fight financial crises. Thus, the rural women should be trained in embroidery to initiate income generating activities at household level. Therefore, the efforts had made to develop skills among rural girls in embroidery by organizing training programmes. The present study was conducted to assess the effectiveness of the training on basic embroidery.

Review of Literature

Gupta and Verma (2013) reported that