International Review of Business and Economics

Volume 1 | Issue 3 Article 30

1-2-2018

Rainfall And Its Impact On Maize Yield

A. S. Kalaivani Ph.D.
Annamalai University

M. Ramesh Ph.D.
Annamalai University

24. RAINFALL AND ITS IMPACT ON MAIZE YIELD

A.S. KALAIVANI, Ph.D. Research Scholar (Full Time), Dept. of Business Admn., Annamalai University, Annamalai Nagar.

Dr. M. RAMESH, Professor, Dept. of Business Administration. Annamalai University, Annamalai Nagar.

ABSTRACT

The present study is to analyze the impact of rainfall on maize yield in Cuddalore district based on ten years data (2005-2006 to 2014-2015). The study conducted with the objective of relationship between area, production, actual rainfall, and maize yield in the study area. The results of the study reveal that actual rainfall adversely affects maize productivity, while the effect of actual rainfall is maximum negative and no significant for maize crops.

KEYWORDS: Maize area, production, rainfall.

INTRODUCTION

Climate is the main factor that influences any agricultural operation starting from field preparation to harvesting. Agriculture which relays on the climatic condition contributes to 10 per cent of Gross Domestic Product and provides employment for about 60 percent of the rural work force in Tamil Nadu. Temperature, humidity, rainfall, wind, atmospheric pressure, precipitation and other metrological condition decides the climatic condition of a particular place. Since the past few years the cropping pattern is experiencing a change due to the weather prevailing in the area. The effects of climate change have been found to have implications for dry land and irrigated crop yields as well as irrigation water use (Rosenzweig & Iglesias, 1994). Except rainfall, all other climatic factors are uniform and have little influence on crop yield. The drastic changes in the rainfall pattern of Tamil Nadu affect the significant area under cultivation.

Tamil Nadu is the eleventh largest and the seventh most populous state (6%) in the country. The cultivated area of the state is 4.7 million ha, comprising 36% of the total geographical area. The irrigated area covering 2.15 million ha is 46% of the cultivated area. The cropping intensity is around 113%. The red and black soils are deficient in nitrogen, phosphorus and zinc. The major crops are rice, jowar, bajra, maize, cotton, groundnut, mungbean, urdbean, banana and sugarcane. A clear knowledge on rainfall of a particular area, it would be possible to plan the production strategies suitable to that area in a better way. The major amount of rainfall is obtained through northeast monsoon followed by southwest monsoon. The table below shows the rainfall, production and productivity of major categories of food crops for the past four years.

The 20th century bears testimony to the indubitable fact of climate change as evidenced by increases in global temperatures and changes in rainfall patterns and rates (IPCC, 2001; Jung et al., 2002). In India, mean temperature, based on data from 73 meteorological stations, has shown a significant increase in warming amounting to 0.4°C over the last 100-year period (Hingane et al., 1985). IPCC has projected that by the end of the 21st century, rainfall over India will increase by 10-12 percent with more frequent and heavy rainfall days while the mean annual temperature will rise by 3-6°C (IPCC, 2014). These changes may culminate in adverse impacts on agriculture in terms of productivity loss, pest and disease increases and labor migration that will threaten food security and agricultural employment. The impact of climate change on agriculture is generally estimated using two broad approaches – agronomic (or crop simulation) and economic modeling, particularly Ricardian approaches (World Bank Report, 2010).

Agronomic methods are based on controlled experiments where crops are grown in field or laboratory settings, simulating different climate and CO2 effects (Aggarwal & Mall, 2002, Saseendran et al., 2000; Hebbar et al., 2008; Geethalakshmi et al., 2011). However, these models do not include farmers' adaptation to changing climate conditions and can overstate the damage caused by climate change (Mendelsohn & Dinar, 1999). The Ricardian models, on the other hand, use cross-sectional data to measure the impact of climate variables on land values or net revenues (Mendelsohn et al., 1994 & 1996; Mendelsohn and Dinar, 1999 & 2003; Kavikumar, 2009). Numerous studies using the Ricardian approach suggest that changes in temperature and rainfall in India could reduce average rice yield by 15 to 25 percent, average wheat yield by 30 to 35 percent (Kavikumar & Parikh, 1998) and farm net income by 8% (Mendelsohn et al., 1994). However, a shortcoming of this approach is the failure to account for time-independent location-specific factors such as the unobservable skills

of farmers and soil quality. In addition to these models, researchers have also used panel data to analyze the sensitivity of yield to weather variables (Chen et al. 2004; Isik & Devadoss, 2006; McCarl et al., 2008). Panel data models with fixed effects address the problems of estimation bias due to the omission of time-independent location-specific variables. Thus, in our study, we use a panel data approach to (i) to measure the impact of climate variables on the yield of major food crops; and (ii) to project the impact of climate change on yield sensitivities using the Regional Climate Model (RegCM4). Researchers often rely on Feasible Generalized Least Squares (FGLS) models for capturing the impact of climate variables, given heteroscedastic panel data (McCarl et al., 2008; Kim & Pang, 2009; Barnwal & Kotani, 2010).

This poses another estimation challenge because the FGLS formula for standard errors assumes that the error process is known and not estimated (Beck & Katz, 1995). But, in panel data models, the error process has a large number of unknown parameters, resulting in unreliable FGLS estimates of the standard errors of estimated coefficients. In this context, Beck and Katz (1995) propose using Panel Corrected Standard Errors (PCSE) models with Monte Carlo analysis. These models perform well and produce accurate estimates of sampling variability even in the presence of complicated panel error structures. Following Beck and Katz (1995), this study employs the PCSE model to measure the impact of climate change on the yield of major food crops in Tamil Nadu, India. An important feature of climate impact modeling is how future climate projections are made. Many impact studies either assume certain changes in climate variables from the baseline or use projections based on coarse resolution 2 South Asian Network for Development and Environmental Economics climate models such as Global Circulation Models (GCMs) (Chen et al., 2004). In this study, we use projections from a Regional Climate Model (RegCM4), which leads to better estimations of future climate conditions since its horizontal resolutions are finer than those of GCMs (IPCC, 2007).

REVIEW OF LITERATURE

Bhatta (2009) investigated the rainfall and temperature pattern for the past 50 years in India. In India, rising average wind speed is responsible for the increase in temperature. Due to high evaporation, rising sea surface temperature and air temperature, high intensity rain occurs. The occurrence of extreme rainfall is increasing and moderate rainfall is decreasing. But moderate rainfall is needed for crop growth. Extreme rainfall above 150 mm per day has increased by 10 per cent per decade for the past 50 years. Besides, after 1980, the temperature in the winter is more than that is in the summer. The maximum winter temperature is 1.25° Celsius, summer temperature is 0.7° Celsius and the minimum temperature is 0.7° Celsius in winter and 0.3° Celsius in summer across the country. Winter season temperature in North India is more than in South India. North India was affected by cold wave in 2002-03 but heat wave in 2003-04.

Swaminathan (2009) examined points out that, not only the rainfall, but also the distribution of rainfall is very important for the survival of crops, cattle and to maintain food security. Temperature variation, frequent droughts and floods are caused by climate changes. Climate is not consistent in India. Regions facing drought during the month of June and July face floods in August and September. Moreover most of the rainfall occurs within 100 hours of a year. This rainfall situation is not good for production and productivity of many crops and affects the poor's livelihood adversely.

Parsai (2009) investigated climate change and its threat to the world is real in the recent days. It is estimated that by 2025, in some parts of Asia and Africa and in India, the crop yields will decline by 20 to 40 per cent as a result of rise in temperature. Moreover climate change will make the land unfit for cultivation and many crops will be affected by pests and diseases. Ultimately, with water shortage and low food production, it is difficult to feed the world population.

Panda (2009) expressed that developing countries are more vulnerable to climate change than developed countries. Agriculture and allied activities are the most affected sector by climate change than other sectors. Indian agriculture basically depends upon temperature and rainfall, and variation in any one of these affects the production and productivity of crops. Ultimately it leads to decline in the GDP growth rate and creates adverse impact on the food security of rural poor and farmers. It is expected that, by 2100, the global mean temperature may increase between 1.4° Celsius and 5.8° Celsius and create much damages to the agricultural sector.

Mathi (2011) examined that globally the production of wheat and maize declined by 5.5 per cent and 3.8% respectively from 1980 to 2008. During this period, in Russia, wheat production declined by 15% due to unfavourable weather. As a result of the unfavorable weather the prices of crops like maize, wheat, rice and soyabean have gone up by 20%. If preventive measures are not taken, by the end of the 21th

century the temperature will reach 2° Celsius. The author forecasts that in Tamil Nadu there will be a 15 to 20 per cent decline in crop production

STUDY AREA

Cuddalore district consists of nine taluks viz. Cuddalore, Panruti, Kurinjipadi, Chidambaram, Kattumannarkoil, Virudhachalam, Bhuvanagiri, Veppur and Tittagudi of which Cuddalore, Kurinjipadi and Chidambaram are coastal taluks lying in the heavy wind and cyclone zone while other five taluks lye in the flood prone zone. Cuddalore is in the highly cyclone prone zone of the East coast and its neighborhood falls under rainfall surplus category with an annual precipitation of 1200 mm and the temperatures vary between 190 C to 260 C in winter and 310 C to 420 C in summer. The district gets rainfall mostly in the months of October to December from the Northeast monsoon recording which accounts for 72 per cent of the total rainfall. 60 per cent of land in Cuddalore district is used for crop cultivation with respect to agriculture crops like rice, maize, ragi. Black gram, green gram, horse gram, sugarcane, turmeric, groundnut, cotton. In Cuddalore district rice is majorly cultivated. So the present study considers the maize yield alone.

STATEMENT OF THE PROBLEM

This study is to determine the rainfall impact on maize yield and factors (area, production, rainfall and yield). In this study to find out the major problem and issue for maize yield affected by rainfall.

Objective of the study

To study the relationship between maize production, area, yield and actual rainfall.

Methodology

This study is descriptive in nature base on secondary data (2005-06 to2014-2015) and collected from agriculture, economics, statistics and meteorological department in Cuddalore district.

ANALYSIS

	Maize area	Maize yield	Maize production	Rainfall
Maize Area				
Maize yield	-.681*			
Maize production	.744*	-.250		
Rainfall	-.043	.434	-.084	

The above table reveals the correlation between maize yields with respected to area, production and annual rainfall in Cuddalore district during 2005-06 to 2014-15. Maize yield (r = -.681), are negatively correlated and there is no significant relationship with maize area. Maize production (r = .744) positively correlated and there is significant relationship with maize area. Annual rainfall (r = -.043) are negatively correlated and there is no significant relationship with maize area. Maize production (r = -.250) are negatively correlated and there is significant relationship with maize yield. Maize yield (r = .434) positively correlated and there is significant relationship with annual rainfall. Annual rainfall (r = -.084) are negatively correlated and there is no significant relationship with maize production. Due to instable rainfall in Cuddalore district during the year 2005-2015 the yield is negatively correlated. Climate change is mostly affected to the crop yield.

CONCLUSION

Cuddalore district has faced extreme weather events like untimely and heavy rainfall and flash floods in affecting huge damage to the major crops and properties of farmers. It is expected that the above-mentioned situation will increase as a function of climate change. Rainfall decides the food grains production and productivity in the significant area in both rain fed and irrigation agriculture. It is identified that the monsoon rainfall are very useful to agriculture production. Predicting the monsoon and deciding the crops as per the monsoon will increase the production of food grains. The catchment reservoirs could be cleaned before the raining season to increase the water holding capacity of the dams which serves as a major irrigation source for the agricultural lands. The government should take the action of national level river linking system/Project soon to save or preserve the agricultural land.

REFERENCES

1.Bhatta. (2009). Rain Shocked. Down to Earth, 17(20), 24 - 31.

2.Mathi, S. (2011). Climate Change Hits Food Production. Down to Earth, 20(3), 50.

3.Panda. (18 April, 2009). Assessing Vulnerability to Climate Change in India. Economic and Political Weekly, 105-107.

4.Parsai, Gargi. (23 Dec, 2009). Climatic Change will hit Small Farmers most. The Hindu.

5.Swaminathan, M.S. (2009). Monsoon Management in Era of Climate Change, The Hindu, 10.