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Effects of Rainfall Variability on Foodgrain and Non-Foodgrain Yield in India

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ABSTRACT
Agriculture is the most significant sector in India. Climate change is one of the most challenging environmental issues as it poses potential threat to several segments of economy at global level. The productivity of agriculture is greatly impacted by climate change, which is a significant issue for both developed and developing nations. Agriculture is mostly reliant on climatic factors and change in climatic conditions affects the production, quality and quantity of crop production in an area. The present paper attempts to analyse the effect of rainfall variability on the area, production and yields of food grain as well as non-food grains in India. The present study uses annual time-series data of food crops and non-food crops for 20 years (2001–2020) Statistical tools like graph, descriptive statistics use for analysis of data. It shows that increase in rainfall increases food and non-food crop production which in turn increases the yield.
Keywords*: Climate change, rainfall, crop production, crop yield*

I. INTRODUCTION

Agriculture is the most significant sector in India. Climate change is one of the highest concerns of everyone as it poses potential threat to environment and agricultural activities all over the world. Agriculture is mostly reliant on climatic factors and change in climatic conditions affects the production, quality and quantity of crop production in an area. Climate change and agriculture are intensely interrelated, therefore variation in climate affects agriculture production. The change in temperature and rainfall conditions affects the growth and development of plants in various ways such as rise in temperature increases the pests vulnerability to different crops and change in rainfall pattern decrease water availability and also affects both the irrigated and rainfed farming activities. Thus, despite the innovations and technological advances, weather still plays a vital role in agricultural yield at the global level.

Climate change have an impact on Indian agriculture in a number of ways. The first is that rain feed more than 60% of India's total agricultural area. Secondly, over 80% of Indian farmers are tiny and marginal, owning less than 1 hectare of land, making them less equipped to deal with the effects of climate change. A third issue is that 700 million people, or more than 52% of the population, depend on livelihoods from climate-sensitive sectors including forestry, fisheries, and agriculture. Of all weather elements rainfall is the most significant for a country like India whose economy is largely based on agriculture. It is generally said that India's prosperity is a gamble of monsoon rains. It affects the production of crops. A regular rain pattern is usually necessary for agriculture, too much or too little rainfall i.e. floods or draught condition is very harmful even destructive to crops.

A region's ability to obtain water resources for agriculture is greatly impacted by variations in the area's average rainfall. Even with the most current technological advancements, climate and weather continue to serve as the most important determinants in agricultural productivity. Climate variables that vary over time, such as temperature and precipitation, have an impact on crop growth phases and, in turn, agricultural output. During the crop season, farmers must make decisions about when to plant crops and apply agricultural inputs due to variations in seasonal rainfall. Due to climatic fluctuation, new problems are emerging, such as intensified disease infestation in crops and the spread of novel agricultural diseases. Offseason high-intensity rainstorm storms frequently result in significant crop loss and financial hardship for farmers.

II. REVIEW OF LITERATURE

Akram Ahmed et al (2019), in their study on assessment of rainfall variability and its impact on groundnut yield in Bundelkhand region. Study analysed the analysed impact on groundnut yield in the study area. The results revealed that groundnut yield had a declining trend for annual rainfall in most parts of Bundelkhand area. The research area's rainfall increases from north to south. In the Jhansi district, groundnut

yield is negatively correlated with rain-fall class 5 types and a delay in the onset of monsoonal rainfall. In contrast, groundnut yield exhibits the highest correlation with rainfall class 3 events and cumulative rainfall amount precipitated during June–July (JJ). According to the report, Bundelkhand is gradually drying up as a result of erratic rainfall, making it difficult to maintain crop productivity.

Rainfall amount
increases from north to south of the study area.
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increases from north to south of the study are Groundnut yield shows the highest correlation with rainfall class 3 events followed by cumulative rainfall amount precipitated during June–July (JJ), whereas rain-fall class 5 type and a delay in onset of monsoonal rainfall are observed to be negatively correlated with groundnut yield for Jhansi district.

Raju Guntukula (2019), the study examined the effect of climate change on the yields of primary food as well as non-food crops in India. The results revealed that the average minimum temperature had an adverse impact on non-food crops, but it had a positive association with food crops. The adverse effects of climatic factors on crop yields may be likely to pose severe implications for food and nutritional security. Conclusively, this study recommended taking adaptation activities to cope with the adverse impacts of climate change.

Deotrephy K. Dkhar (2017), made a study on effect of Rainfall Variability on Rice Yield in North Eastern Hills of India: A Case Study. The study investigated the effect of Rainfall Variability on Rice Yield. The findings of the study was monsoon rainfall showed increasing but insignificant trend, whereas significant increasing trend in rainfall was observed in post-monsoon rainfall and the annual rainfall show increasing but insignificant trend in Meghalaya during 1975–2007. The effect of monsoon maximum temperature was positive and significant on yield of rice. The rainfall in the state was highly erratic in nature, the farmers must be provided with valid weather information for crop planning.

Savita Ahlawat (2015), made a study on Climate change and food production in North West India. The study examined the effects of only two parameters of climate i.e. temperature and rainfall on agricultural production in northwest region of India. The results of the study revealed that the yield of wheat and rice showed signs of stagnation and reduction respectively in the selected area due to change in required climatic conditions. These environmental variations are likely to increase the pressure on agricultural sector, in addition to the on-going stresses of yield stagnation, land-use, competition for land, water and other resources and globalization.

OBJECTIVES OF THE STUDY

1. To study the relationship between rainfall with food grain production and yield.
2. To study the relationship between rainfall with non-food grain production and yield.

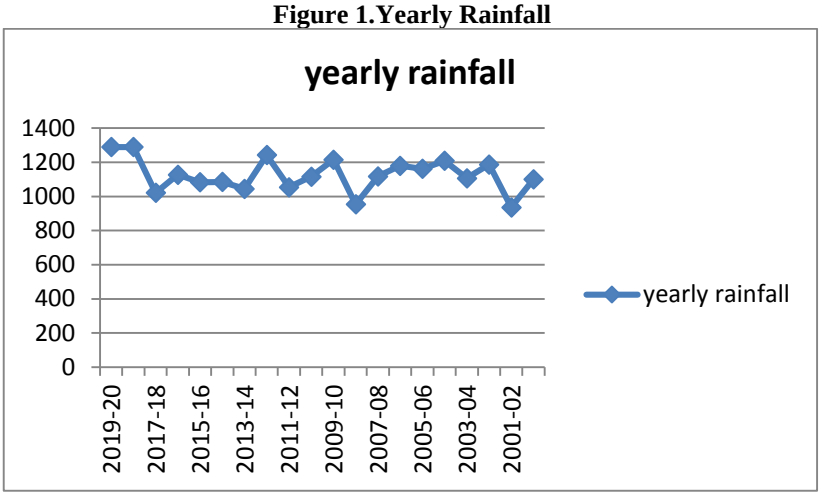
III. RESEARCH METHODOLOGY

To achieve this objective, this study uses the annual time-series secondary data. The study covers the 20 years data 2000-01 to 2019-20. This study uses annual rainfall, food and non-food crops data. The data on agricultural productivity and crop production were collected from Handbook of Statistics on Indian Economy, Reserve Bank of India. Information on Climatic rainfall data were gathered from the India Meteorological Department.

IV. RESULT AND DISSCUSSION

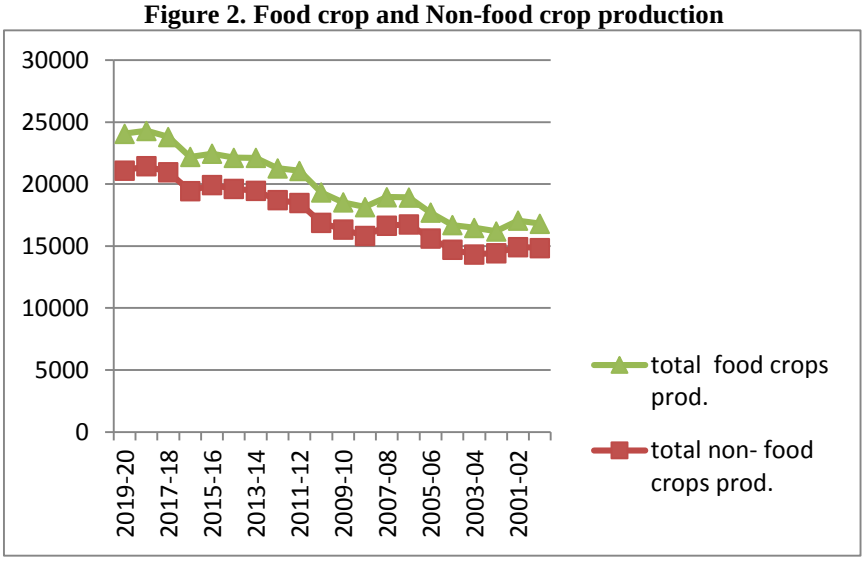
This analysis shows the yearly rainfall, food crop production, non-food crop production, food crop yield, non-food crop yield in the study year 2000-01 to 2019-20 has been discussed.

Figure 1.Yearly Rainfall



The above diagram shows that the yearly rainfall in India during the study period 2000-01 to 2019-20. The yearly rainfall data has been increased from 1100.7mm in 2000-01 to 1289.6mm 2019-20. There is a fluctuation in the yearly rainfall in India during the study period 2000-01 to 2019-20.

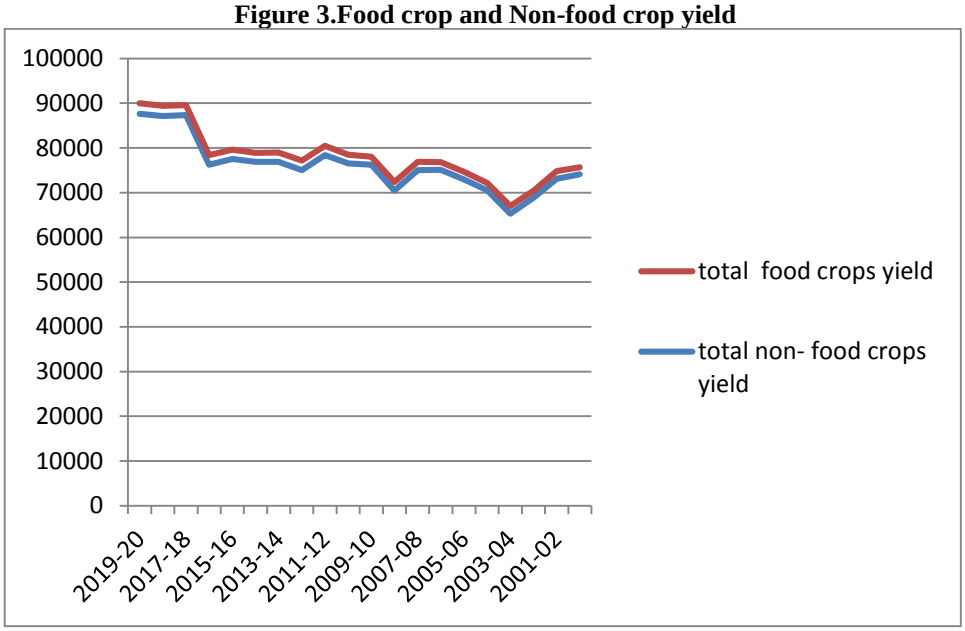
Figure 2. Food crop and Non-food crop production



The above diagram shows that the yearly food crop production and non-food crop production in India during the study period 2000-01 to 2019-20. The yearly non-food crop production data has been increased from 14845 lakh tonnes in 2000-01 to 21093 lakh tonnes in 2019-20. There is a fluctuation in the yearly non-food crop production in India during the study period 2000-01 to 2019-20.

It is inferred from the diagram that the yearly food crop production in India during the study period 2000-01 to 2019-20. The yearly food crop production data has been increased from 1968 lakh tonnes in 2000-01 to 2975 lakh tonnes in 2019-20. There is a fluctuation in the yearly non-food crop production in India during the study period 2000-01 to 2019-20.

Figure 3.Food crop and Non-food crop yield



It is inferred from the diagram that the yearly food crop yield and food crop yield in India during the study period 2000-01 to 2019-20. The yearly food crop yield data has been increased from 1626 lakh tonnes in 2000-01 to 2343 lakh tonnes in 2019-20. There is a fluctuation in the yearly food crop yield in India during the study period 2000-01 to 2019-20. It is observed from the diagram that the yearly food crop yield and non-food crop yield in India during the study period 2000-01 to 2019-20. The yearly non-food crop yield data has been increased from 74085 lakh tonnes in 2000-01 to 87655 lakh tonnes in 2019-20. There is a fluctuation in the yearly non-food crop yield in India during the study period 2000-01 to 2019-20.

Table1. Descriptive Statistics

Variable	No	Maximum	Minimum	Mean	Std. deviation
Rainfall	20	935.9	1289.6	1125.955	98.1001
Non food crop production	20	14337	21450	17522.20	2418.694
Food crop production	20	1748	2975	2388.85	336.908
Non food crop yield	20	65281	87655	76067.40	5841.072
Food crop yield	20	1535	2343	1934.65	237.361

The descriptive statistics and the result shows that the yearly rainfall data over the last 20 years period is 1125.95. The non-food crop production and food crop production are 17522.20 and 2388.85 with the standard deviation of 2418.69 and 336.908 respectively. The mean value of non-food crop yield is 76067.40 of the rainfall data in India and standard deviation of 5841.072. The mean value of the food crop yield over the past 20 years is 1934.65 with the standard deviation of 237.361.

V. CONCLUSION

Climate change is one of the highest concerns of everyone as it poses potential threat to environment and agricultural activities. Agriculture is the most significant sector in India. Of all weather elements rainfall is the most significant for a country like India whose economy is largely based on agriculture. It is generally said that India's prosperity is a gamble of monsoon rains. The fluctuation of rainfall closely relates to food crop and non-food crop production in the study period 2000-01 to 2019-20. It shows that increase in rainfall increases food and non-food crop production which in turn increases the yield.

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