

Impact of Rainfall on Indian Economy: With Reference to Crop Production

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Abstract

It is a well-known fact that agriculture is measured as the strength of India's economy. The world wide studies through different researchers have shown that the rainfall has great impact on the crop production which ultimately influences our economy. In India we could differentiate the different type of available crops broadly as Rabi, Kharif and Zaid where the growth of Kharif crop majorly depends on the rainfall. This growth of crop ultimately impacts the Indian economy as 22.5 percent of Rajasthan state's GDP (Gross Domestic Product) comes from agriculture alone. This paper is presented here to analyze the impact of rainfall on the productivity of different kind of crops and to evaluate the economic effect of Kharif crop production onto it which further influences the states GDP growth.

Keywords: Rainfall, Environment Change, Agricultural Impacts, Rabi and Kharif Crops.

1. Introduction

Agriculture is a major source of India's economic growth. It has a large contribution in Indian GDP by adding 16.5% GVA (Gross Value Added) in 2019-20. As we know in India we grow three main kinds of crops namely Kharif, Rabi and Zaid, where the production of Kharif crops mainly depends upon the rainfall. The Kharif Crops includes Bajra, pulses, Jowar, maize, gaur and groundnuts as the major crop elements. Kharif crops include rice, maize, sorghum, pearl millet/bajra, finger millet/ragi (cereals), arhar (pulses), soyabean, groundnut (oilseeds), cotton etc. In India, the monsoon season starts in June and ends in October. The Kharif crops are harvested at the end of the monsoon season October or November month. By end of July, 2020, the total Kharif crops has been sown on 882.18 lakh hectare (hectare) area against 774.38 lakh hectare (ha) area during the corresponding period of last year (2019). 266.60 lakh hectare area covered under rice and about 111.91 lakh hectare area covered under pulses. Coarse Cereals covered 148.34 lakh hectare areas, about 175.34 lakh hectare area covered under oilseeds. Sugarcane covers 51.78 lakh hectare area, Jute & Mesta covers about 6.95 lakh hectare areas and Cotton covers 121.25 lakh hectare areas. So, it's well known fact that the rainfall plays a crucial role in the economy of our country and our farmers. Here, Weather works alike to a "natural experiment" meanwhile it has peripheral causes [1]. There is a random control on economic events. Whereas we are capable to distinguish the statistical fundamental influence of weather on economic results [2].

So, here the paper is presented to evaluate the crop production against the data sets of the rainfall which is then compared with the economic growth of the country in the specific time stamp. In this way the paper concludes that there is an impact on our economic growth due to the rainfall. This further focuses on the reasons of protecting our environment not only for the human health but also for the productivity of the crops which is a major source of Indian economy as India is a land of Farmers. This paper is structured as: The first section having introduction, the second section with literature review on existing studies and the impact of rainfall on economic conditions of farmers. The next section has dataset details and methodology to evaluate the proportionality of rainfall with the crop production and further the financial growth of the country. The

results are discussed in 4th section and in the last section the conclusion is stated to focus on the need of increasing rainfall in the country with the evidences of different specific reasons.

2. Literature Review

Siriklao Sangkhapha and Yang Shu discovered the influence of rainfall on the progress of the gross provincial product (GPP) by economic sector. They used provincial-level panel data from the time period of 1995 to 2015 for analysis. In the regression model they used FGLS (feasible generalized least squares) estimator along with fixed influence. The results show that the chief effects of the weather are fallen with help of rainfall and reduced GDP growth. Experiments also demonstrate that the rainfall had a negative influence on the agriculture [1]. Marcelo Torres and et al., introduced a novel hydro-financial model with planning and forces of precipitation influence the profitability of an in part inundated horticultural framework in Brazil. The result recommended that rainfall timing was an essential economic parameter and models that were used to find out influences of water shortage on agricultural income predict underestimate values [2].

Mariana Camarin Gazonato and Maria Aparecida Silva Oliveira analyzed the limit of Brazilian economy segments to move their profitability increases over the beneficial chain from 2000 to 2009. In this manner, it has been utilized basic disintegration procedure and a philosophy that manages the variety of work efficiently. The after effects of this article yield in the period under audit are that the Services and not the Industry were answerable for transmitting these additions of efficiency. Be that as it may, the intensity of transmission of efficiency variety of the tertiary part comes to be moderately low when contrasted with the capacity of the Industry to transmit its profitable varieties [3]. Tara Iyer and Abhijit Sen Gupta built a toolbox to now cast, or produce timely gauges of GDP development in India. They utilized a dynamic factor model (DFM) to now cast GDP development in India on a quarterly premise from January 2000 to December 2018. The results shown that, the precipitation has high prescient substance for GDP development in India [4].

Shreekant Gupta et al. examined the impacts of precipitation and temperature on yields of paddy and millets (pearl millet and sorghum) in India for the period 1966–1999 [5]. Julie A. Silva and Corene J. Matyas have built a connection amongst precipitation and economic well of the monetary prosperity of rustic agriculturalists in Mozambique, who fundamentally depend on down pour took care of agribusiness for food and salary. Authors built up connection by isolating the examination locale into precipitation zones dependent on the level of ordinary precipitation got during the developing seasons and from two tropical typhoons at every one of 536 towns. The precipitation examination uncovered that four of the nine precipitation zones experienced outrageous wet or dry conditions, while high month to month and inter-annual fluctuation in precipitation happened all through the nation [6]. Abdul Rehman examined the relationship between rural GDP and the yields of major crops. These crops were sugarcane, wheat, maize, rice and cotton. They collected data of GDP and crops production from different publication over the time of 1950 to 2015 of Pakistan. They used ADF unit root test, common least square strategy and Johansen's co-ordination test for analysis of data. The results of analysis using regression represented that the output of maize, wheat, cotton and rice have positive relationships GDP. The output of the sugarcane has a negative impact on GDP [7]. Khaled Ramadan Elbeydi experimentally researched the causal connections between GDP and agricultural production. In this experiment the author used annual time series data of the Libya during the time period of 1970 to 2012. Error correction, integration and Granger causality methods were implemented to regulate the long run equilibrium relationship. The integration test showed the presence of long run equilibrium association among agricultural production and the GDP. These results demonstrated that the agricultural section play a vital role in GDP of Libya [8]. Abidoeye et al., examined the experimental connection between economic growth and climate variation in Africa. In the experiment they used annual data of 34 countries from 1961 to 2009 time

period. They find out negative influence of climate variation on economic growth of these countries. The experimental results show a 1°C increase in temperature decreases gross domestic product (GDP) growth by 0.67 percentage points. They also find out that there was no impact of average long-run temperature changes on long-run economic growth, they average 5 years temperature [9].

M. Gilmont et al., examined relationship between Indian state-level economic and rainfall data from 1961 to 2012. In experimental dataset, from 15 Indian states, those populations exceeding 20 million as of 2000 and totaling 920 million people, about 12% of the global population. From experimental results, they found that some patterns of interdependence between rainfall inconsistency and economic growth. They found continuous correlation of rainfall and economic growth rates [10]. Berlemann et al., have analyzed short term and long term economic growth effected by rainfall variations. For experimental analysis, they collected 150 countries data from 1951 to 2013. From experiment, they found strong and extremely robust empirical proof for long-lasting negative growth effects of rainfall more on poor and underdeveloped countries [11]. Lertamphainont et al., investigated the impact of rainfall variation, how rainfall effect human life in term of floods and droughts, how affect income, consumption, and coping responses of farming households in Thailand. They collected household-level data from repeated cross-sectional farm household surveys over the time of 2006-2010. From data analysis, they find out that crop income falls sharply as result of rainfall variation. Also find out the emphasize wealth-differentiated effects of rainfall shocks as landless households seem more vulnerable to rainfall shocks than landholding households due to their limited ability to smooth income and consumption [12].

3. Data and Methodology

3.1 Data source

In this paper the data for Rainfall and crop production is collected from Agriculture department, Government of Rajasthan. Here, we have chosen Rajasthan state average rainfalls in millimeter from 2010 to 2018 for our study and experimentation. The results of Crop data is also taken from 2010 to 2018 time period of total production of Rajasthan state of all three types of crops namely Rabi, Kharif and Zaid.

3.2 Methodology

In this analysis we select Rajasthan state total crop production on entire year and state average rainfall in that particular year of all districts. The Rabi crops are winter crops, seeded in October or November months and get product in March and April months. The Kharif crops are summer, seeded in June or July and get product in September or October. Zaid crops are summer season crops and they grow in time period from March to June. Here, the Linear Regression is used to show relationship between rainfall and crop production (Productivity per hectare Rabi and Kharif (kg/hectare), Productivity per hectare Rabi (kg/hectare), Productivity per hectare Kharif (kg/hectare), Total production Rabi and Kharif (Tonnes), Total production Rabi (Tonnes), and Total production Kharif (Tonnes). This methodology is used to evaluate the growth of crop in relation to the rainfall occurred so that a proper comparison could be made to note the impact of rainfall onto the crop production.

4. Results Analysis

The following table-1 show Statistics of state average rainfall, productivity and production with detail of minimum, maximum, mean, standard deviation (S.D.) and Coefficient of Variation (CV).

Table-1: Statistics of state average rainfall, productivity and production

Indicator	State average rainfall (MM)	Productivity (kg/hectare)			Production (Tonnes)		
		Total	Rabi season	Kharif season	Total	Rabi season	Kharif season
Minimum	464.00	1202.00	1873.00	745.00	30667740.00	16886820.00	12342637.00
Maximum	719.90	1386.00	2271.00	1061.00	36155659.00	21906279.00	16842656.00
Mean	555.49	1298.44	2005.11	888.33	33222358.22	19014653.33	14207704.89
S.D.	94.34	60.01	152.35	84.77	1537730.06	1302759.203	1233483.904
Coefficient of Variation (CV)	0.17	0.05	0.076	0.096	0.046	0.068513434	0.086817956

The figure-1 represents year wise total crop productivity along with Rabi and Kharif season individually.

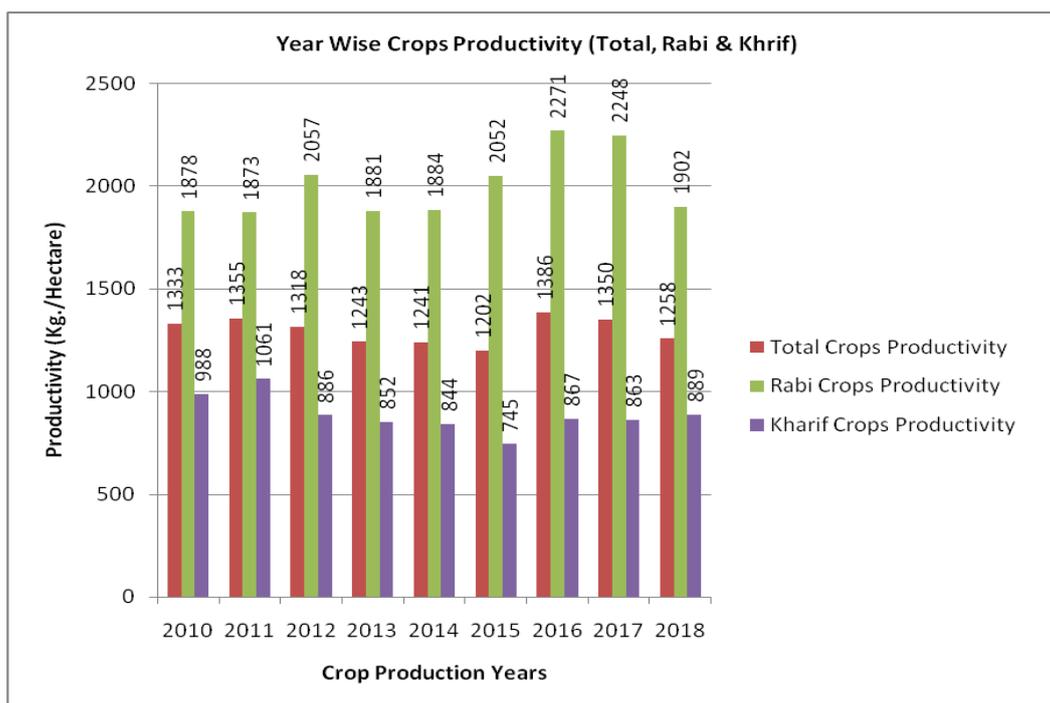


Figure-1: Yearwise total productivity, Rabi crops productivity and Kharif crops productivity

The figure-2 shows the correlation between rainfall and total productivity (Kg./Ha) of Rabi, Kharif and Zaid crops. From graph we can conclude that that rainfall has great impact on all types of crop production.

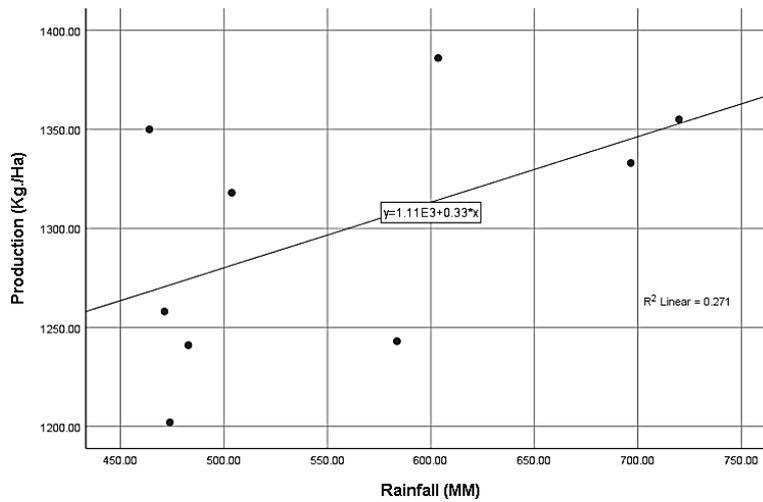


Figure-2: Rainfall and total productivity (Kg./Ha)

The figure-3 shows the correlation between rainfall and total productivity (Kg./Ha) of Rabi crops. In graph we can see that Rabi crops production have negative correlation with rainfall, because Rabi crops are fully depends on other irrigation System, with compared to rainfall.

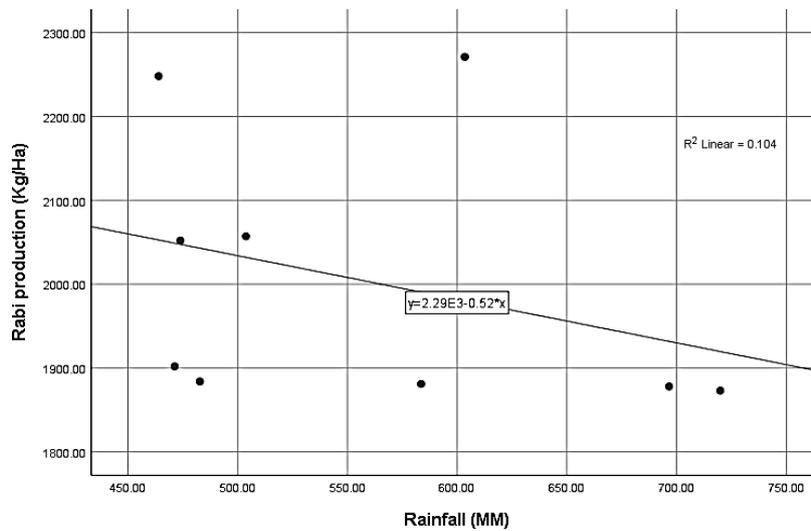


Figure-3: Rainfall and Rabi productivity (Kg./Ha)

The figure-4 shows the correlation between rainfall and total productivity (Kg./Ha) of Kharif crops. In graph we can see that Kharif crops production have high positive correlation with rainfall, because Kharif crops are fully dependent on rainfall.

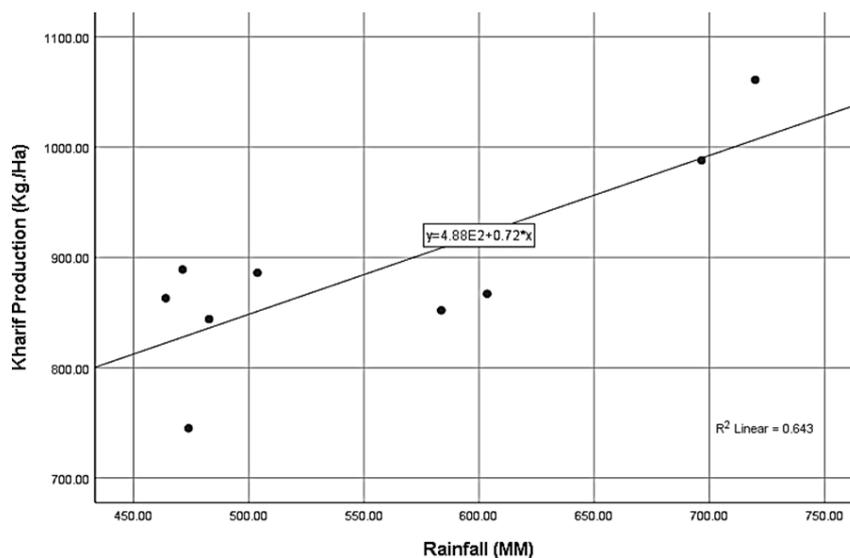


Figure-4: Rainfall and Kharif productivity (Kg./Ha)

5. Conclusion

The present paper concludes that the agriculture is measured as the strength of India's economy as there is a large support from agriculture in Indian GDP (Gross Domestic Product), by adding 16.5% GVA (Gross Value Added) in 2019-20. In this paper we performed the analysis of the impact of rainfall on different season of crops and then calculated the productivity to find out the economic growth of the region due to the rainfall. For this, the Rainfall and crop production data is taken from the Agriculture department, Government of Rajasthan. Then, Rajasthan state average rainfalls in millimeter from 2010 to 2018 are taken for experimentation. This data is taken from 2010 to 2018 time period of total production of Rajasthan state of all three seasons of crops as mentioned in the paper. The results showed that, there is a positive impact of state average rainfall onto the total Kharif crop production.

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