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Speculation of Monsoon Rainfall and Reciprocity of Crop Yield and Production in Nashik District of Maharashtra, India

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Abstract:

Indian Monsoon Rainfall is a gamble for the Indian farmers and the policy makers in terms of variability. Rainfall is a main role player in the Indian economy & agricultural productivity. Uneven variability of rainfall is the main cause behind the lacking economical condition of Indian farmers besides that it is also the challenge before the governing authority to plan for the regional imbalance. We are trying to evaluate the reciprocity of Indian Monsoon and the agricultural yield and production through various ways.

Key Words: Monsoon, Crop Yield, Rainfall Speculation, Crop Production, Variability.

Introduction:

Monsoon Rainfall Trend of the Nashik District from 1980 to 2016 is identified from this research paper by examining the rainfall trend over district about 37 years; we have got maximum temporal data to analyze the character of the rainfall. The district influenced by the South-West Monsoon Season meanwhile followed by Retreating monsoon season rainfall distribution is mainly from western parts having excess rainfall while middle part of the district having moderate rainfall and eastern and south eastern part having scarcity of rainfall. Nashik District is having colourful geographical features. According to rainfall relation we also analyze the temporal change in Crop Yield and Crop Production and evaluate correlation of Crop Yield and Crop Production in Nashik District.

Study Region:

Nasik district lying between 19°35’18” North latitude to 20°53’07” North latitude and 73°16’07” East longitude to 74°56’27” East longitude, with an area 15530 sq.km. and population of 6,109,052, as per the 2011 census. There are 15 Tahasil and 66 revenue circles are in the Nashik district.

Nashik district is situated in the Deccan trap of Maharashtra which is partly in the Tapi Basin and partly in the upper Godavari Basin. The main stream of hills in the

Sahyadri which is runs North-South in the western proportion of the district. Ajanta range which runs right across the district. It acts as a watershed between the Girna and its tributaries which drain towards the Tapi to the north and the Godavari and its tributaries to the south. More area of this region is in the rain shadow zone which is called as rain fed area. Drought is the phenomenon which affects the cropping pattern and agricultural development. So we are interested to find out some concrete solution for the agricultural development of this region.

Objectives:

1) To find out Monsoon Rainfall Trend of the Nashik District from 1980 to 2016

2) To evaluate temporal change in Crop Yield and Crop Production

3) To evaluate correlation of Crop Yield and Crop Production in Nashik District

Methodology:

This study is depending upon last 37 years data of rainfall which is obtained from 'India Meteorological Department, Pune and Hydrological Department, Nashik. We are using following Statistical methods for analysis.

1. **Mean** is calculated by using the following formula.

$$\bar{x} = \frac{\sum x}{n}$$

Where, $\bar{x}$ = mean Σx = is the sum of the rainfall value

n = total number of values.

2. **Trend** Analysis by Statistical Technique

3. A linear **Correlation regression** line has an equation of the form $\boldsymbol{Y = a + bX}$, where $\boldsymbol{X}$ is the explanatory variable and $\boldsymbol{Y}$ is the dependent variable. The slope of the line is $\boldsymbol{b}$, and $\boldsymbol{a}$ is the intercept (the value of $\boldsymbol{y}$ when $\boldsymbol{x} = 0$).

Connotation:

We are discussing about the Monsoon Rainfall Trend of the Nashik District from Year: 1980-2016 and Temporal Change & Correlation of Crop Yield and Crop Production.

A. Monsoon Rainfall Trend of the Nashik District from Year: 1980-2016

In this research paper we are analyzing South-West and Retreating Monsoon Rainfall Characteristics of Study Area for better understanding of Rainfall fluctuations during the 37 Years.

Sr.No.	Tahsil	South -West Monsoon Season Average Rainfall in MM (June-Sept.)	Retreating Monsoon Season Average Rainfall in MM (Oct – Nov)
1	Surgana	705.849	127.724
2	Peth	640.8895	111.725
3	Trimbak	824.48025	136.113
4	Igatpuri	915.30925	184.3615
5	Nashik	525.9555	132.3235
6	Dindori	479.535	116.3065
7	Satana	446.2935	100.7735
8	Kalvan	428.52325	104.356
9	Niphad	420.12475	96.463
10	Sinner	356.4215	76.6495
11	Yeola	304.0355	63.507
12	Chandvad	278.20775	58.736
13	Nandagaon	280.6395	56.292
14	Malegaon	269.330475	50.682
15	Deola	251.87325	41.787
Total Average		471.8311983	97.1866

Table: 1 South –West & Retreating Monsoon Season Average Rainfall Nashik District
Years: 1980-2016

Above table (**Table: 1)** shows the monthly rainfall characteristics of the rainfall for the period from 1980 to 2016 .Mainly the distribution of rainfall is uneven in all the Tahsils ,During October and November it was normal. During June, July, August and September that is South West Monsoon Period Rainfall is Excess to Normal in The District. If we are considering rainfall During June, July, August and September that is South West Monsoon Period Surgana, Peth, Trimbak and Igatpuri Tahsils having more than average rainfall among them Igatpuri Tahsil having excess rainfall .While Nashik, Dindori, Satana, Kalvan and Niphad having normal rainfall but Sinner, Yeola, Chandwad, Nandgaon, Malegaon and Deola Tahsils are having Scarcity of Rainfall compare to others. South-West Monsoon rainfall characteristics for the period from 1980 to 2016 rainfall During June, July, August and September Surgana (705.849mm), Peth (640.8895mm), Trimbak (824.48025mm) and Igatpuri (915.30925mm) Tahsils having more than average rainfall among them Igatpuri Tahsil having excess rainfall .

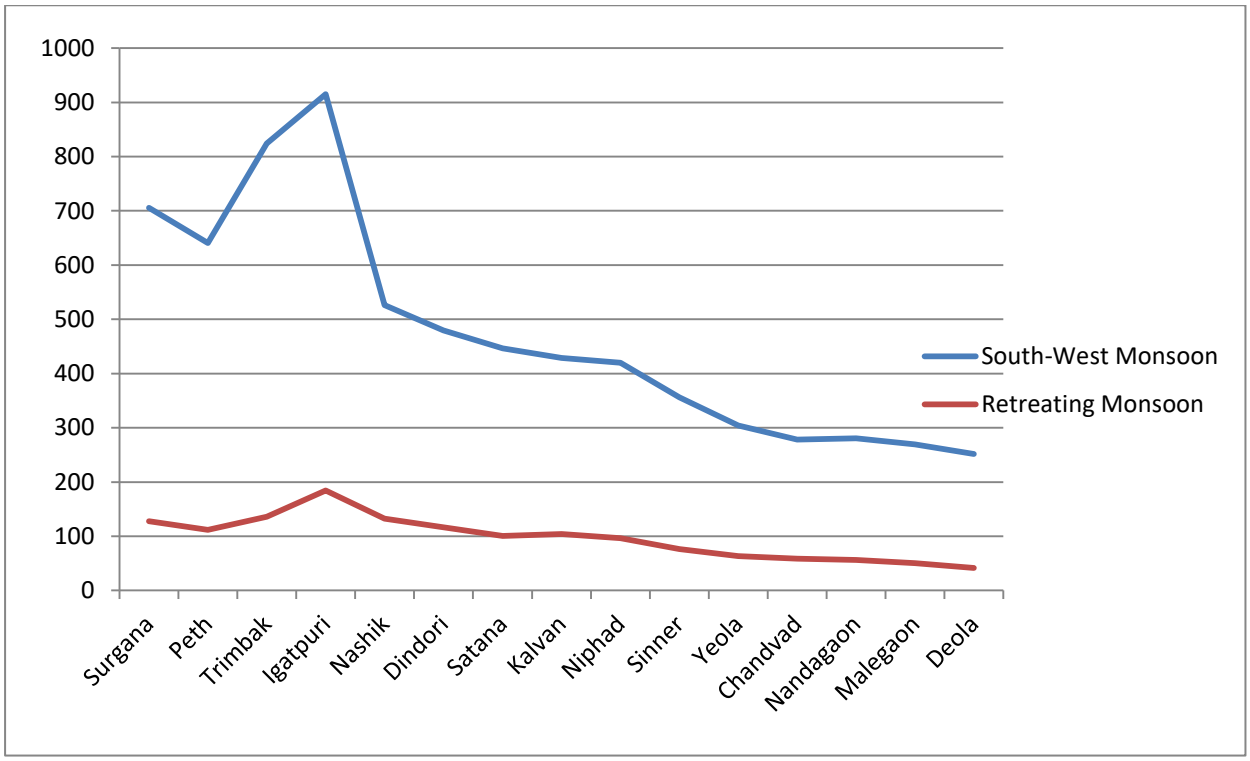

Fig.1 Monsoon Rainfall (in MM) Trend of the Nashik District from Year: 1980-2016

While Nashik, Dindori, Satana, Kalvan and Niphad having normal rainfall but Sinner (356.4215mm), Yeola (304.0355mm), Chandwad (278.20775mm), Nandgaon (280.6395mm), Malegaon (269.330475mm) and Tahsils having more than average rainfall among them Igatpuri Tahsil having excess rainfall .While Nashik, Dindori, Satana, Kalvan and Niphad having normal rainfall but Sinner (356.4215mm), Yeola (304.0355mm), Chandwad (278.20775mm), Nandgaon (280.6395mm), Malegaon (269.330475mm) and Deola (251.87325mm) Tahsils are having Scarcity of Rainfall compare to others .

Trend Graph **(Fig.: 1)** also shows the clear picture of the uneven distribution of the rainfall over the study region during whole period average. Igatpuri Tahsil SW region of Study area having high Rainfall while Deola Tahsil having low Rainfall which is situating North Eastern of study region. Following Malegaon NE region, while Nandgaon, Yeola and Sinner SE region of study region having low trend of rainfall.Remaing Tahsils namely Nashik, Dindori, Satana, Kalvan and Niphad having Moderate Trend of rainfall distribution over the study region during the Year 1980 to Year 2016.

B. Temporal Change Crop Yield and Crop Production

Following table shows the temporal changes and correlation of crop yield and production from the year 1980 to year 2008.

Sr. No.	Name Of Crop	Year							
		1980-1981		1990-1991		2000-2001		2007-2008	
		Yield/KG	Production /00 'MT	Yield/KG	Production /00 'MT	Yield/KG	Production /00 'MT	Yield/KG	Production /00 'MT
1	Rice	1113	452	1060	424	875	398	1352	684
2	Wheat	884	931	1024	912	1129	445	1886	1490
3	Jawar	865	743	887	720	664	184	620	64
4	Bajara	549	1008	635	2296	539	1869	1110	2395
5	Maize	1421	27	852	69	655	148	2884	2933
6	Ragi	876	431	949	447	480	215	787	260
7	Total Pulses	343	370	499	562	407	367	683	676
8	Total Oil Seeds	2632	795	1738	439	1600	230	1966	366
9	Sugarcane	9020	1759	111785	35426	91000	22845	86000	43063
10	Cotton	882	45	1750	14	170	57	329	761
Correlation		0.73		0.99		0.99		0.99	

Table: 2 Temporal Change & Correlation of Crop Yield (Kg/Per Hectare) and Crop Production (00'Metric Tonnes)

Above Table: 2 & Fig.2 shows Temporal Change & Correlation of Crop Yield (Kg/Per Hectare) and Crop Production (00'Metric Tonnes) temporal change for the Maize, Oil Seeds, and Sugarcane is having increasing trend while other crops like Wheat, Jawar, Bajara, Ragi Cotton, Pulses ,Rice having normal temporal trend for the decades from 1980-2008.

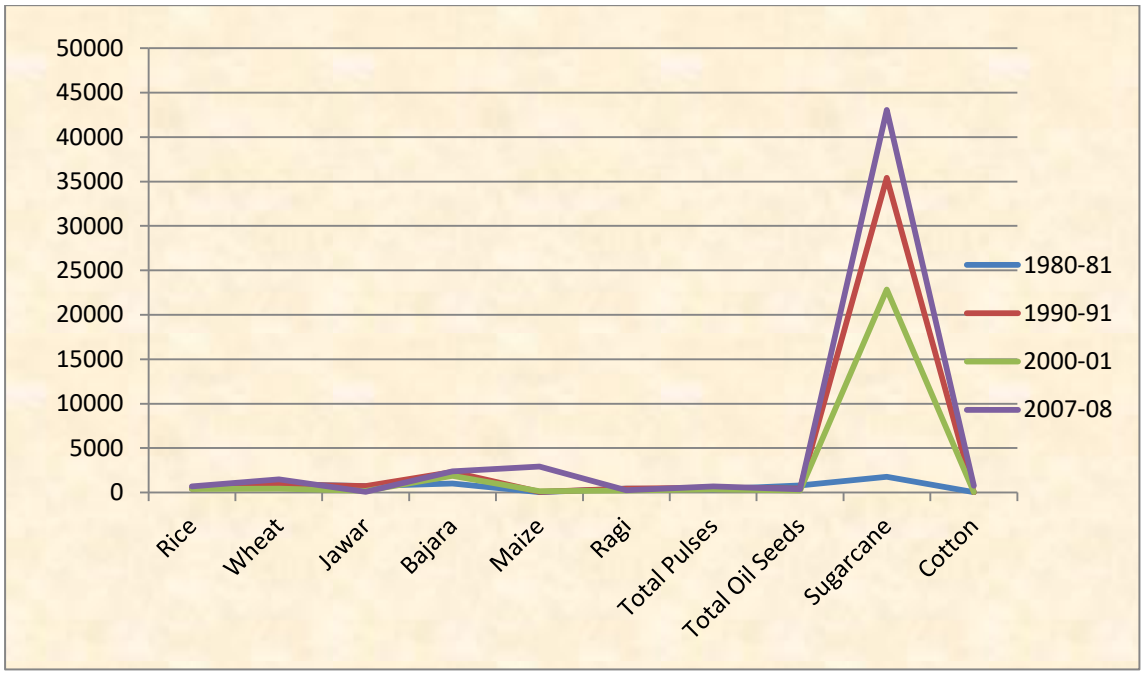

Fig.2 Production of Selected Crops in the Nashik District from Year: 1980-2008

C. Correlation Regression for Crop Yield and Crop Production

Correlation for the all decade is normal or positive while in1980-81 it showes little bit low than the other decades we are showes in the correlation graph the two decades correlation i.e.1980-81 and 2007-2008 both are having positive correlation but values of correlation was different in the first decade it is 0.73 while in last decade it is 0.99.

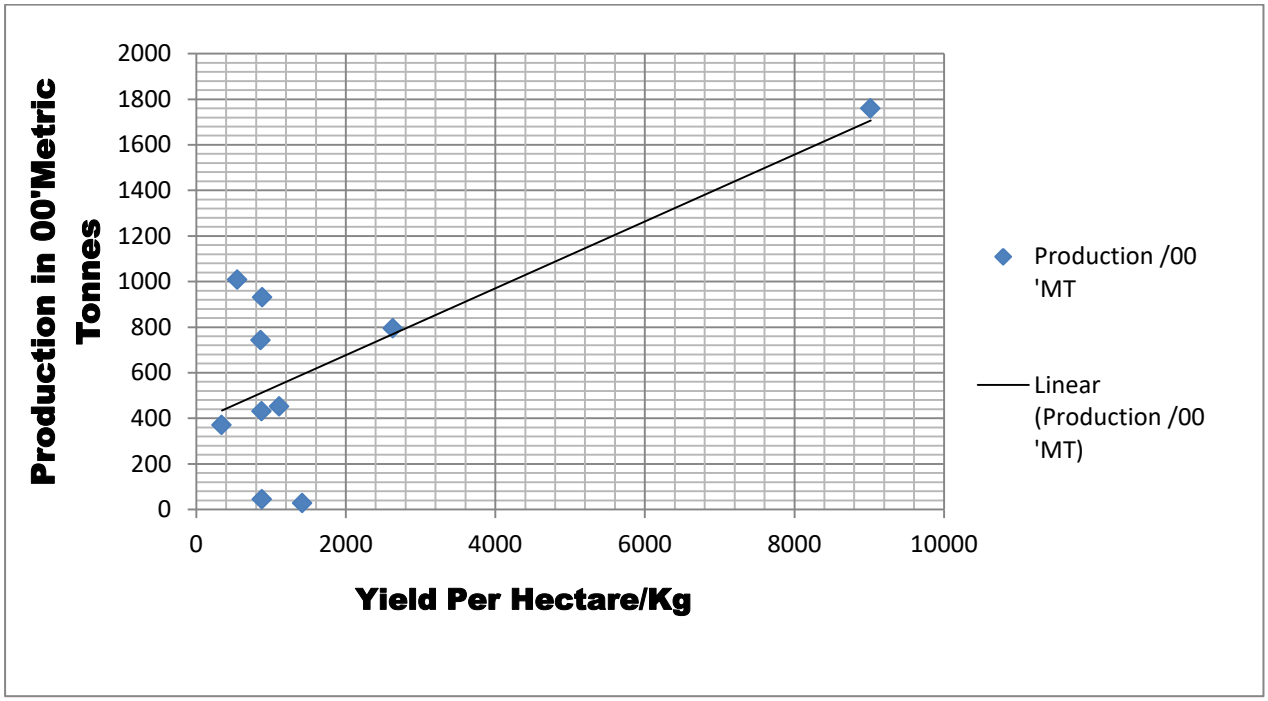

Fig .3 Correlation Graph Crop Yield and Total Production Year: 1980-1981

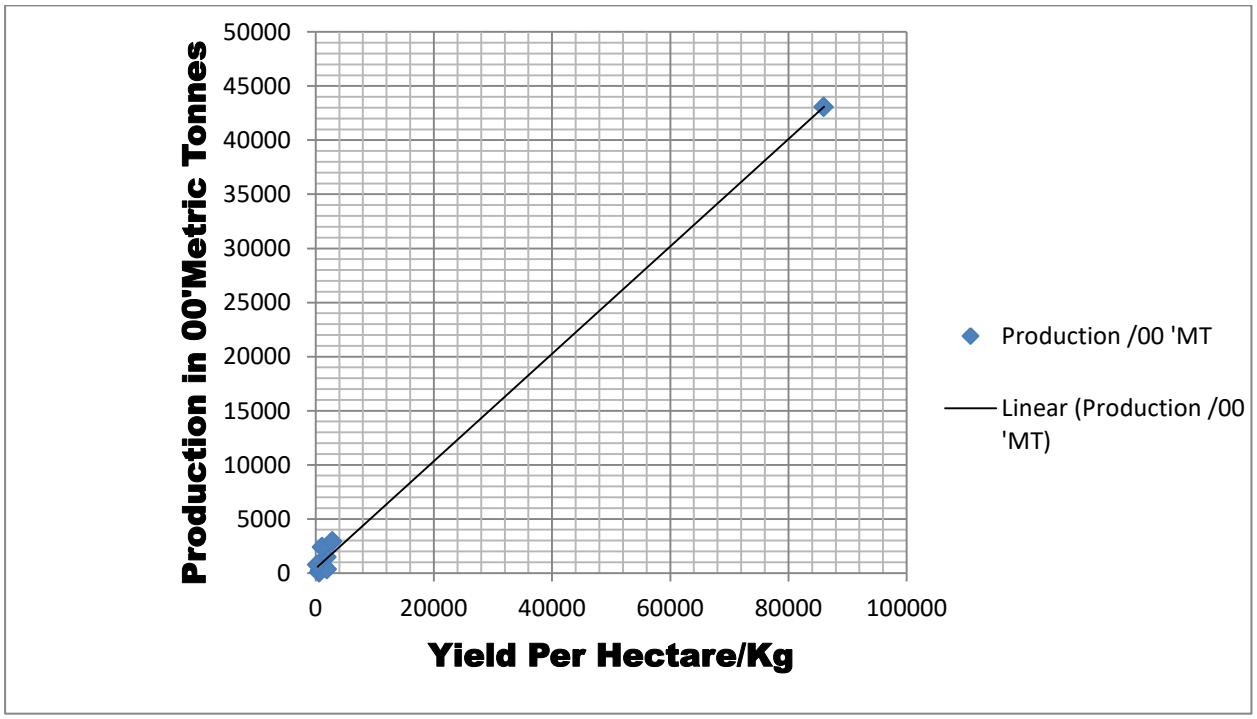

Fig .4 Correlation Graph Crop Yield and Total Production Year: 2007-2008

Production of all crops are scattered in 1980-81 while in2007-2008 it is more integreted but commen factor is the production and yield of the sugarcane is showing higher trend for the both decades.

Conclusion:

Monsoon rains are covering most of India's traditional grain belt in the Western and middle parts nearly two weeks later than usual. The rains bring much-needed relief to farmers and politicians, who feared the effects of a late monsoon on crops like Grains, Sugar and Rice.

The South -West monsoon is a system of winds that reverse direction at roughly the same time every year. As they move up and down the Indian subcontinent, these winds carry fresh water to hundreds of millions of farmers. Consequently, the usually highly predictable monsoon rains are the lifeblood of agriculture throughout the Indian subcontinent. The monsoon has two phases. The first carries moisture from the Arabian Sea up through the Indian subcontinent. It begins in June and covers most of India with rain until September. In late September, these winds reach the Himalayas and make an abrupt about-face. From late October to December, the monsoon glides back down over the subcontinent on its way to the Indian Ocean. In the first phase of Monsoon Nashik district rainfall and productivity correlation is normal but in the second phase it will be uneven. The rains are crucial not only for farmers, but for its economy as a whole in study area. Most parts of Nashik District don't have irrigation systems that farmers can turn to in an emergency, so even when rains are late or weak (as they have been this year), farmers have no ways to supplement them. Farmers need a way to power those irrigation systems also. Anxiety over delayed rains is nothing new in study area. This is a staple Phenomenon of Study areas human life. Its effects reach far beyond agricultural output, shaping political dynamics and farmers' suicides.

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