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# Variability of rainfall on the productivity of rice (*Oryza sativa* L.) of eastern Uttar Pradesh

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### Abstract

The daily rainfall data for the period of 1992 to 2011 of Eastern U.P. were analyzed to rainfall variability. Variability and Trends of rainfall for monsoon months show high, total of rainfall, total number of rainy days and length of monsoon season affected the productivity of rainfed rice. Further analysis of daily and weekly rainfall data suggests that when the quantum of rainfall during the monsoon months was close to its normal value the low production of rice can be attributed to the moisture stress during vegetative and reproductive stage of rice crop. This study provides help to former for enhancing the production of rainfed rice when plant growth is directly affected by aberrant weather.

**Keywords:** Rainfall; rainfed rice; rainfall variability; rainy days; rainy season

## Introduction

Rice (*Oryza sativa L.*) is an important crop of Eastern Uttar Pradesh. In Eastern Uttar Pradesh rice is grown in almost all the district. The climatic factors that influence rice production are temperature, sun shine hours and humidity. Rainfall and its duration is very important for rice cultivation the rainfall is main limiting factor affecting crop productivity. Therefore, its amount, time of occurrence and spatial variability controls the agriculture practices. The variability of rainfall and its effect on crop productivity, especially in context of rice production, has been an important subject of study particularly for rainfed area, {Rao and Vijayalakshmi 1993, Ramana Rao *et al*; 1993, Sastri and Patel, 1984) [3, 3, 6]. Consequential to variability of rainfall during the monsoon period and events associated with it, even this low level of practices. Rainfall is a crucial agro climatological factor in the seasonally arid parts of the world and its analysis is an important for agricultural planning. Therefore a case study has been conducted for this region to understand the exact effect of rainfall variability on rainfed rice production and suggest, if any remedial measure to stabilize rainfed rice production at satisfactorily high level.

## Material and Methods

The daily rainfall data for the period of 20 years (1992-2011) have been collected from State Agriculture department Lucknow. Data regarding productivity of rice for the period 1992-2011 has been taken from Agriculture Statistic of Uttar Pradesh. The average rainfall for the monsoon months 822.2 mm and 1906 kg/ha is the productivity of rainfed rice. Normal dates of onset and withdrawal of south-west monsoon are 19 June and 25 September respectively and on an average duration of south-west monsoon is 99 days having 48 rainy days.

## Results and Discussion

Average productivity of rainfed rice during the period of report was only at 1906 kg/ha and varied between 1580 kg/ha and 2290 kg/ha. Thus productivity of rice has not been only low but also highly unstable during the period of report, when green revolution has made its impact all over the country. Maximum area of rice is rainfed and therefore larger proportion of the variability in yield can be attributed to one of the main elements of weather, i.e. rainfall, in term of quantum and its pattern of distribution during the south-west monsoon months. It is shown from figure 1 that in most of the year's rice production is in consonance with quantum of rainfall of south-west monsoon months. Yield levels of rainfed rice are observed with the length of rainy season and rainy days during the monsoon season as shown in Table 1.

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Rice yield were found to be significantly correlated with quantum of rainfall, while only in few years, productivity of rice does not match with either of rainfall feature mentioned above. For rainfed rice, yield variation in these years can be explained by quantum of rainfall during critical vegetative and reproductive phase. Grain filling stage normally occurs at faizabad during 38-41 SMW after withdrawal of monsoon, deficit soil moisture during this phase drastically reduces the grain yield even if there was a normal rainfall during preceding phases. For example in 2000 rainfall and duration of monsoon, both were above normal even then yield was lower then it's average value of because there was no rainfall in SWM 37 and onward and crops suffered moisture stress during grain filling stage. The rice yield does not match with total quantum of rainfall, variation are largely due to improper distribution of rainfall and rainfall received during the grain filling stage of rice crop.

**Table 1:** Rainfall during (1992-2011) monsoon months & yield of rainfed rice at Faizabad.

| S. No | Year | Rainfall (mm) | Rainy days (days) | Length of Rainy season (days) | Yield (kg/ha) |
|-------|------|---------------|-------------------|-------------------------------|---------------|
| 1 | 1992 | 779.1 | 51 | 96 | 1580 |
| 2 | 1993 | 890.8 | 53 | 97 | 1580 |
| 3 | 1994 | 974.5 | 49 | 93 | 1810 |
| 4 | 1995 | 848.3 | 51 | 97 | 1560 |
| 5 | 1996 | 744.4 | 50 | 102 | 1980 |
| 6 | 1997 | 772 | 46 | 98 | 1880 |
| 7 | 1998 | 719.3 | 42 | 96 | 1880 |
| 8 | 1999 | 1147.8 | 62 | 99 | 2070 |
| 9 | 2000 | 1034 | 53 | 103 | 1910 |
| 10 | 2001 | 909.1 | 53 | 94 | 2060 |
| 11 | 2002 | 658.3 | 43 | 106 | 1780 |
| 12 | 2003 | 943 | 54 | 99 | 2180 |
| 13 | 2004 | 716.4 | 43 | 103 | 1820 |
| 14 | 2005 | 908.1 | 44 | 95 | 1900 |
| 15 | 2006 | 568.3 | 33 | 93 | 1770 |
| 16 | 2007 | 634.1 | 41 | 109 | 1890 |
| 17 | 2008 | 982.5 | 63 | 111 | 2130 |
| 18 | 2009 | 612.5 | 38 | 95 | 1950 |
| 19 | 2010 | 748.8 | 44 | 90 | 2110 |
| 20 | 2011 | 852.5 | 51 | 100 | 2290 |
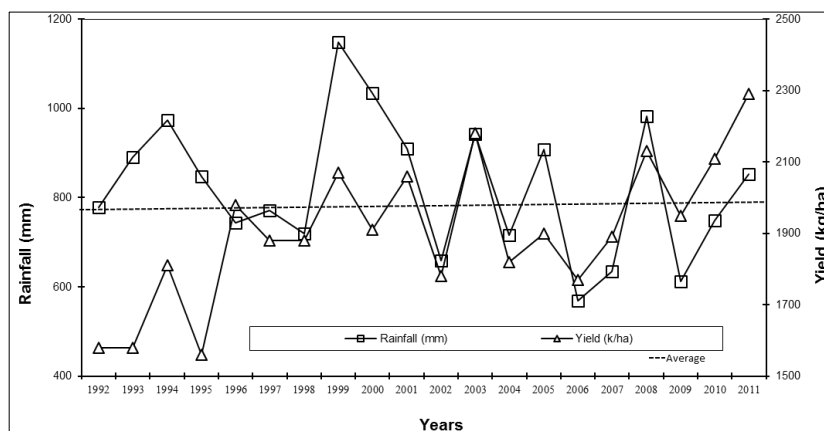


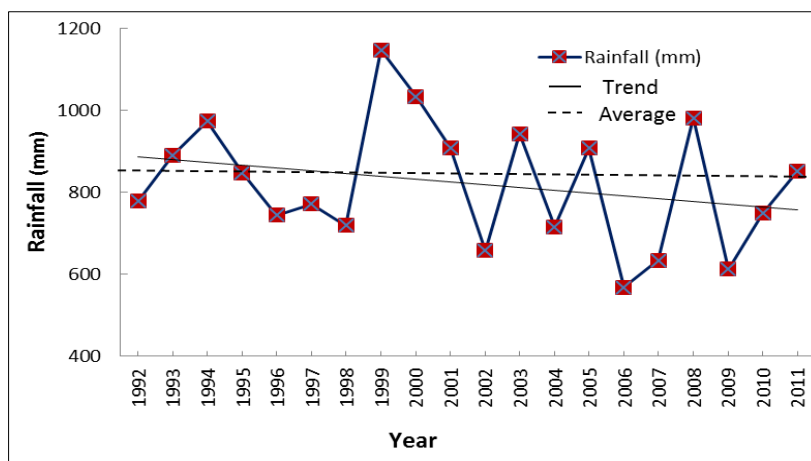**Fig 1:** Variability of rice yield in relation to seasonal rainfall



**Fig 2:** Trend of South West monsoon rainfall (mm) (1992-2011).

## Conclusion

Therefore for obtaining higher productivity of rainfed rice either surplus rain water efficiently managed to overcome the moisture stress during the reproductive phase. This study will provide help to the farmer for selection of short duration varieties for better utilization of water, selection of crop and cropping pattern etc.

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