

Monsoons

How important is the weather in determining India's groundnut production?

The weather has a profound effect on the production of food worldwide. In a monsoon country such as India, rainfall is the most important weather variable.

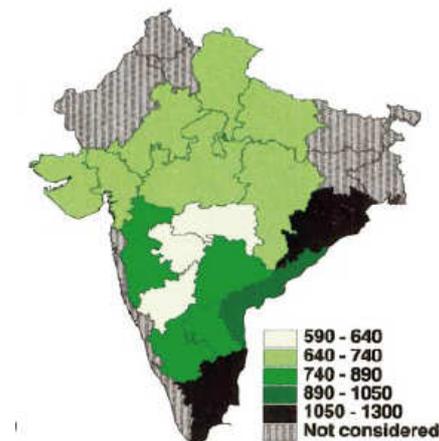
Background Information

The characteristics of rainfall in India are dominated by two monsoons, the winter (northeast) and summer (southwest) monsoons. The summer monsoon is the strongest, and is the one relevant to the main groundnut growing season throughout most of India. The Indian summer monsoon is part of a larger scale circulation pattern known as the Asian summer monsoon which develops in response to the large thermal gradients between the warm Asian continent to the north and the cooler Indian Ocean to the south. The strong southwesterly flow in the lower troposphere brings a substantial supply of moisture into India, which is released as rainfall primarily along the Western Ghats of India and over the northeast subdivisions bordering the Bay of Bengal. During



June–September, the rainfall associated with the monsoon provides the main source of freshwater for millions of people in India. Over 90% of the annual mean rainfall occurs during the summer months. The start of the monsoon over the Bay of Bengal is usually within a week of the end of May, and it then spreads North and West until it covers the whole of India by mid-July. However, there can be large differences in the amount of rainfall each region receives, which, coupled with year to year variability in the strength of the monsoon, can mean droughts or floods with associated economic and social consequences.

Groundnut (peanut) is grown for its oil, and India and China are the two largest producers in the world. It is a crop that is mainly watered directly by rain, rather than by irrigation systems. Over time, improved crop varieties, use of irrigation and fertilizer have led to an increase in yield (the amount of groundnut harvested per hectare).



Groundnut yield from 1966-1990, in kg per hectare

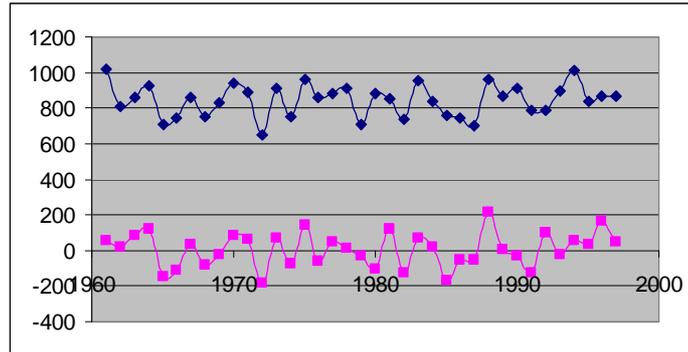
Data

The data set contains rainfall and groundnut yield for the whole of India. The yield data has been detrended – that means that any year-on-year increase (or decrease) in productivity has been removed, to better show up differences between individual years.

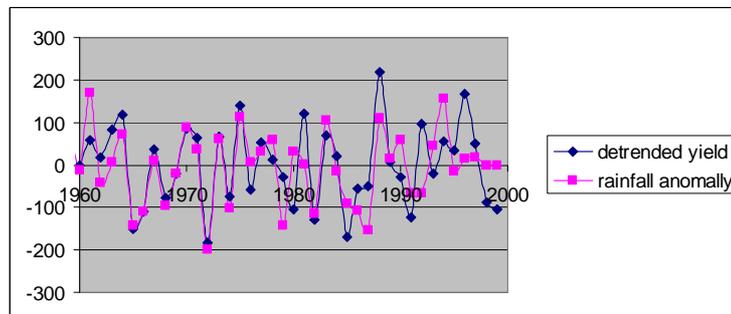
The data is contained in an Excel spreadsheet, with three columns – year, detrended yield and rainfall.

Students can:

- Plot the data using the Excel chart wizard. What is the appropriate plot type (we recommend xy scatter)?



- Consider what the data shows.
- Consider how it would be easier to see a relationship between the two variables. (We recommend looking at the rainfall anomaly. To do this, use the Excel 'average' function to calculate the average rainfall in the period, then, in a new column, take this average away from each year's rainfall. Then plot a new graph. By doing this, the rainfall and yield curves will be brought together).



- Use an appropriate statistical test to see whether there is a correlation between yield and rainfall.

Challinor *et al.* (2003) found that, on the all-India scale, June–September rainfall explains over one-half of the variance in detrended yield between 1961 and 1995. One of the reasons there is not a better correlation is that looking at the annual rainfall hides smaller time scale information about whether the rains were continuous, or had 'active' and 'break' periods. The amount of rainfall in September is actually crucial for groundnut yield.

Farmers can reduce their dependency on the monsoon by introducing irrigation. Some regions are less affected by rainfall variance than others – it depends on whether there is usually more than enough rain, or whether there is usually only just enough.



Further recommended monsoon resources:

BBC documentary (available on DVD) **Orbit: Earth's extraordinary journey** episode 3

<http://www.teachindiaproject.org/Lessons.htm>

<http://www.tes.co.uk/teaching-resource/Flooding-in-Bangladesh-Cause-Effect-and-Solution-6175576/>

<http://www.tes.co.uk/teaching-resource/Monsoon-and-amp-Climat-Graph-Worksheet-6038079/>

<http://www.coolgeography.co.uk/A-level/AQA/Year%2013/Weather%20and%20climate/Tropics/Tropics%20-%20monsoons.htm>

<http://www.chembakolli.com>

<http://www.geography.org.uk/resources/pakistanfloods/>

This resource was produced using data and images kindly supplied by Prof. A. Challinor from the University of Leeds and based on the paper by Challinor, Slingo, Wheeler, Crauford and Grimes (2003).

