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# Rainfall analysis for agricultural production in the Nigerian savanna

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Rainfall is increasingly a source of concern, particularly in the rainfed agricultural areas of the world. Typical of this rainfed agricultural area is the West African Savanna, where the scarcity of water and uncertainties in both the amount received and in spread, have continued to pose major constraints to the rational development of agriculture and have contributed significantly to the poor yields and high variability in crop production from year to year. The almost total dependence of agriculture on rainfall in the savanna implies that any meaningful agricultural research within the zone must incorporate an assessment of this resource.

The IAR (Institute for Agricultural Research), right from its establishment in 1927, began collecting weather data as a routine to aid the interpretation of field research data. This paper will discuss the results that have so far emerged from analyses of the weather data and what problems exist in the application of these results to agricultural planning and production in the Nigerian savanna.

## Sources of data

Establishments involved in the generation of meteorological data in Nigeria include:
- the Federal Department of Meteorology;
- government farm centres;

- schools;
- agricultural research institutes;
- inland waterways;
- private companies;
- river basin authorities;
- utility boards;
- agricultural development projects.

The Federal Department of Meteorology, Farm Centres, Schools, Inland Waterways and Agricultural Research Institutes were the primary sources of agrometeorological data through the nineteen-sixties and early seventies but most stations located in the Farm Centres and Schools have since closed down while the contribution from the Federal Department of Meteorology has dwindled to data from airports alone.

The IAR built and maintened five agrometeorological stations. In addition to data generated at these stations, the Institute collects data from all the other sources in the Nigerian savanna and presently has a data pool of over 160 stations. The extent of the data in terms of the number of factors measured and the period of coverage varies from station to station. The minimum length of data is 10 while the maximum is 80 years.

## Analytical methods

Until recently, Kowal and Knabe [1] had been virtually the only reference on the rainfall analysis of the Nigerian savanna. The authors provided means, standard deviation and confidence limits of rainfall at 148 stations. Akintola [2] broadened the scope of this study by including stations throughout Nigeria.

The two-part model of Stern [3] and Stern *et al* [4] which employed the Markov chain for the occurence of rain and the gamma distribution for the spacing of lengths of dry spell enabled further characterization of rainfall using the example of a few stations only. Earlier works of Garbutt *et al* [5] analysed the mean lenght of dry or wet spells and the mean rainfall per rainy day while Stern *et al* [6] used a modelling approach to estimate the chance and distribution of rain at Kano (Lat. 12° 03'N and Long. 08° 32'E).

More recently, the computation of constant precipitation and constant probability as well as initial or conditional probability by the methods of Virmani *et al.* [7] was introduced into the West African savanna (for example [8-10]). The highlights of the findings of these studies and others related to the application of the results to crop production will be discussed below.

## Rainfall distribution

A reliable estimate of the start of the rainy season is important to agriculture. First, the start of the rains comes at the time of highest demand on farm equipment and labour as