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TRADITIONAL FARMERS' PERCEPTION OF THE SOILS IN THE NANUMBA DISTRICT OF GHANA.

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Abstract

Soil classification is normally based on profile characteristics, genesis as well as chemical and physical characteristics systems. Traditional farmers all over Ghana have their own classifications based on colour, texture and coarse material content of the soils. In the Nanumba District farmers have come out with four major soils based on this criteria as against seven by Soil Scientists. However, comparing the two classifications there are not many differences between them. With regard to the agronomic values of the Soils both soil scientists and traditional farmers are almost in total agreement. The only differences that occur are due to the fact that the soil scientist bases agronomic values on the ranges of possibilities offered by the soils and climate while the traditional farmer, in addition, considers the culture of the area.

For food production to be increased, soil scientists and extension officers must be conversant with traditional farmers' classification and perception, so as to be effective in transferring scientific knowledge to the farmers.

Introduction

The Nanumba district is partially in the Oti and the Daka River Basins and covers an area of about 2,000km^2. It is bounded on the north and west by Eastern Gonja, on the south by the Kete Krachi district, and on the east by Eastern Dagbon and the Republic of Togo (Fig. 1).

The Oti River Basin is known to be a very important food producing area. Yam is the predominant crop grown followed by maize, sorghum, millet, beans and groundnuts.

A soil survey of this area was conducted as part of the Oti Basin Soil Survey and information on crop production collected. Agriculture relies heavily on farmers' perception of the environment and the modern scientific knowledge is yet to be transferred to them. Even if they do, it will not be easy to impart this knowledge since most of the farmers are illiterate. It may therefore be more useful to investigate and merge farmers' perception of the soils with scientific knowledge.

The idea of making use of farmers' perception in agriculture is not new in Ghana. Benneh (1970) in his study on the attitude of the Kusasi Farmers of the Northern Region of Ghana pointed out that the Agricultural scientist, in order to improve farming techniques, cannot

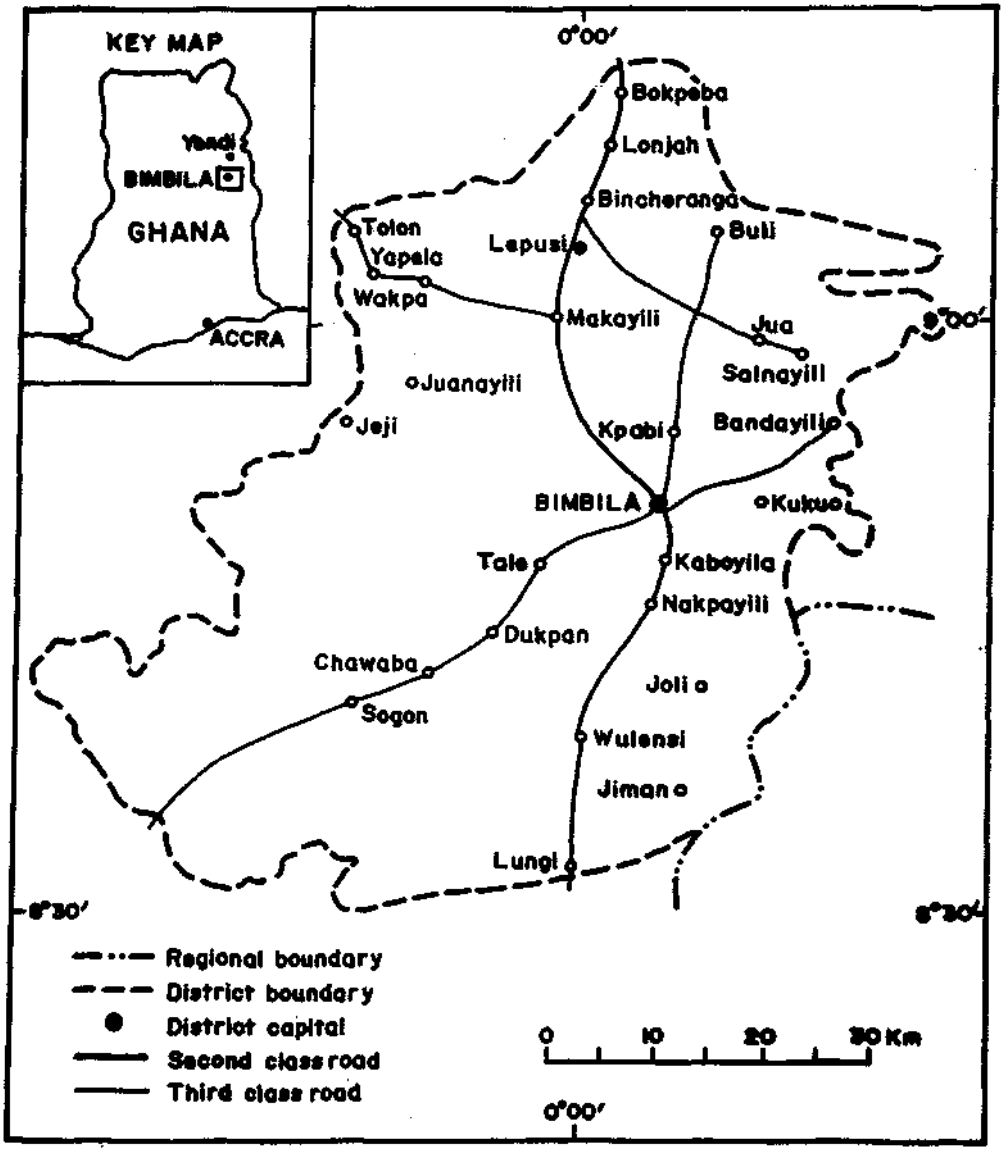

Fig. 1 NANUMBA DISTRICT

afford to ignore the wealth of acknowledge accumulated over the years by indigenous farmers, on the physical environment.

In this paper, the scientific classification of the soils of the area has been compared with the traditional farmers' classification. Suggestions have been made as to how best the traditional farmer can be helped to improve his agricultural techniques.

The study was conducted in the Oti Basin lying in the Savannah Climate Zone of Ghana.

Physical Background

The study area experiences a single peak rainy season. The monthly totals rise slowly from March to June and then fall rapidly after September (Fig. 2). Average maximum temperatures are highest in March. The highest temperatures usually occur in April or May just at the beginning of the rains. The lowest average temperatures occur in August. The annual mean maximum temperature at Yendi is 33°C while the average daily mean is 27°C.

The district is covered by Guinea Savannah woodland vegetation. In its typical form, it consists of short-statured trees usually not forming a close canopy and very often widely spaced. The ground flora is composed of a continuous layer of grass. Many of the trees are fire resistant and have thick barks. Root suckers are also numerous and play a very important part in regeneration.

Riverine woodland vegetation is found along the major rivers and streams as the Oti and the Mo. The Guinea savannah woodland consists of ***Parkia Filicodes***, and ***Detarium Senegalenses***. **Anogeissus schimperi Acacias** are also very frequent. Riverine woodland areas have ***Kyaya senegalenses*** as the dominant trees. However, in most places most of the trees have been cut for fuel, and only trees of commercial value such as ***Butyrospernum, Parkia, Acacia, Andansonia*** and ***Bliglia sapida*** remain. The dominant grasses are ***Heteropogon Contontus, Imperata cylindrica*** and ***Pennisetum polystackyion***.

Method

The area was surveyed using the semi-detailed reconnaissance method described by Ahn (1970) on the scale of 1:250,000. This involves the use of roads, paths and cutline traverses. The traverses were about 3 - 4km apart and were chained and pegged at 10m intervals. The soils were identified along these traverses. Five big time farmers including the chief farmer of the area were interviewed and taken to the field at different times to identify the soils according to their traditional method. The five farmers all gave the same names for the soils as well as their indicator plants.

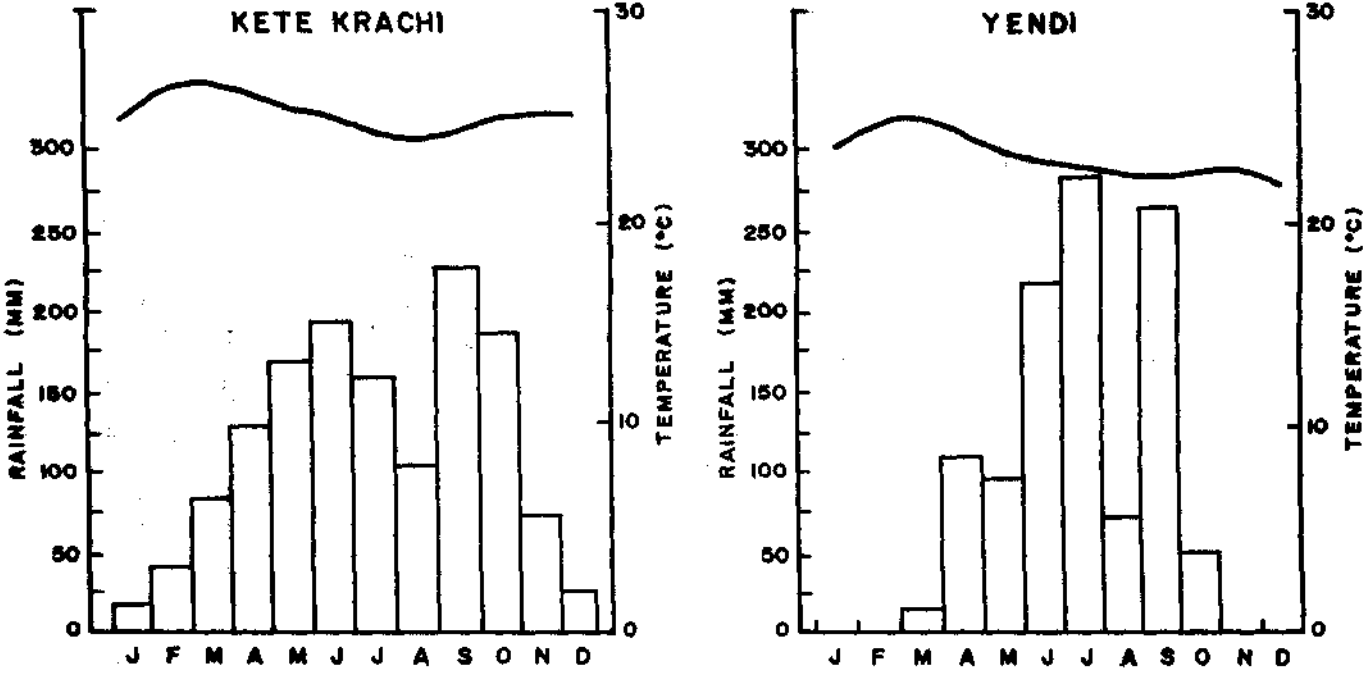

Fig. 2 MEAN MONTHLY/ANNUAL RAINFALL AND TEMPERATURE FOR KETE KRACHI AND YENDI

Source: Ghana Meteorological Service Yearly Summary 1959. Note No. 5

Results

The soils found in the district are developed on Voltaian sandstones, mudstones and shales. However, the most extensive soils found in the area are those over Voltaian sandstones. Scientifically, these soils have been classified as the Ejura-Amantin-Denteso soil Association (Smith, 1962). On the summit and upper slopes occur **Wenchi, Kintampo, Techiman** and **Ejura series**. On the middle to lower slopes occur **Amantin series** followed on the lower to bottom slopes by **Dentenso series**. The valley bottom soil, Sene series, is however not very common apparently because part of the areas covered had been taken up by the Volta Lake. Detailed description of the soils has been given below.

Wenchi Series - the series occurs as small isolated patches on summit and upper slope sites in the district. It is a very shallow soil consisting of frequent to abundant ironstone concretions and pieces of iron pan in brown to reddish brown fine matrix. This layer is underlain by massive ironstone at less than 30cm from the surface. Elsewhere in the area erosion has caused the exposure of the ironpan at the surface.

Kintampo Series (Lithic Ustorthent, USDA): This soil also occurs in small patches on summits and upper slopes. Occasionally it may also be found along stream banks where there is a break of slope. It is a very shallow soil consisting of very frequent to abundant pieces of sandstone in a brown to reddish brown loamy sand matrix. This layer overlies massive sandstone rock at less than 30cm from the surface.

Techiman Series (Rhodic Paleustalf, USDA): The soil occurs on summit and upper slope sites where gradients rarely exceed 2- per cent.

Normally the profile consists of 1 - 1.5 meters of frequent to abundant iron concretion and ferruginized sandstone brash in a fine sandy loam to clay matrix. The dominant colour is reddish brown to yellowish red but the top 20 - 30cm is usually stained dark greyish brown to dark brown by organic matter. The concretionary layer grades below into decomposing yellowish or reddish feldspathic sandstone. In some localised areas the concretionary layers of the Techiman soils overlie ironpan usually at the depth of more than 40cm. The ironstone is often compact but friable and generally consists of ferruginized sandstone brash which passes gradually downwards into weathered sandstone.

Ejura Series (Typic Paleustalf, USDA): These soils occur on the upper summits of the sloping topography. They consist of deep, well drained yellowish red sandy loams free of gravel.

The typical Ejura series are characterised by 5 - 8cm of dark yellowish brown sandy loam top soil which is generally dry and leached and with a low to moderate organic matter content. The topsoil overlies a yellowish red sandy clay loam subsoil followed at about 2 meters by a mottled layer horizon overlaying weathering sandstone or ironpan which commonly develops over the sandstone.

Apart from the typical Ejura soils a shallow phase of it occurs in irregular patches within the main body of the deeper Ejura soils. This soil is free of concretions and stones for up to about a meter. It has a slightly lower clay content so that the soil is somewhat droughty.

Amantin Series (Typic Paleustalf, USDA): These are deep, imperfectly drained, hillwash soils occurring on middle to lower slopes of gently sloping topography. They sometimes occur at depressional sites of the upper and middle slopes.

The normal profile consists of 0 - 30cm of dark brown loamy fine sands over a horizon (30 - 120cm) which consists of strong brown fine sandy to loam material. This overlies a strong brown, mottled reddish brown, fine sandy clay loam horizon.

Dentenso Series (Arenic Paleustalf, USDA) : **Dentenso series** is the valley bottom soil of the association. It is poorly drained and derived mainly as wash from Amantin and Ejura series.

The normal profile consists of 0.30cm of pinkish grey, loamy fine sand, over a meter of pinkish grey mottled brown fine sand with frequent tiny pan boulders and sandstone gravel which overlie ironpan.

Traditional Farmers Perception of the soils

The soils described above were based on soil series which is the basic unit of soil classification consisting of soils that are essentially alike in all major profile characteristics except the texture of the A-horizon.

However, traditional farmers identify and classify their soils not according to profile characteristics but on colour, texture and coarse material content. In addition, indicator plants are used for their identification. Below is a Nanumba classification of the soils in the district.

Tandanze soils are red and are found on summits and upper slope and are normally associated with ***pulalom, Aristida Kerstingu*** as major indicator plants.

Bihigu soil - This occurs in the middle slopes. It is dark brown sandy loam or fine loamy sands. This soil is not as perfectly drained as **Tandanze soils**.

The soil is associated with ***Discorea sp*** and ***Prima*** as the major indicator plants. This soil is the **Ejura** series in the scientific classification.

Batampeni soil is the lower valley bottom soil and is characteristically loamy sands. It is poorly drained and farmers associate it also with ***Andropogon gayanuus.***
Bayagri soils are found in the valley bottoms. They are normally waterlogged in the rainy season and crack during the dry season. This is the **Sene soil series** described in the scientific classification. They are however not very common in the study area. Farmers associate ***Vetiveria***

nigritina as the major indicator plant.

Taeringa soils are shallow summit and upper slope soils with ironstone concretion and ironpan at a depth of less than 30cm.

Agronomic Value

Wenchi series (*Taeringa*) is non-agricultural being too shallow, too concretionary and too droughty to be cultivated. **Techiman series** (*Tandanze*) is permeable throughout. Run-off is moderate and internal drainage is somewhat excessive so that they dry out speedily in the dry season. The shallowness of the top soil together with the doughtiness restrict the agricultural value of these soils.

The soils are near neutral to slightly acid in the top soils but throughout the concretionary subsoil, acidity increases very slightly with depth. Maize, sorghum, millet and groundnuts can be cultivated with success on the soils.

They require careful tillage and management as top soil erosion often leads to the exposure of the concretionary subsoil. The soils are therefore marginal for mechanized cultivation and deep ploughing must be avoided.

Ejura Series: (*Bihiga*) is well drained for the first one meter of the profile. Thereafter, drainage is somewhat imperfect. The topsoil tends to be droughty but subsoil moisture is retained longer in the dry season than in the case of the **Techiman series**. Because of its depth, non-concretionary nature and the absence of stones it can be tilled easily both by hand and with machines. Topsoil reaction is neutral but subsoil horizons, are generally slightly acid with values which lie around pH6.2.

Ejura soils are ideal for the cultivation of maize but yams, sorghum, tobacco, kenaf, cotton, soya beans, millet and a variety of crops may be profitably grown on the series. It is susceptible to erosion and therefore contour ploughing and mulching need to be maintained in order to check soil losses (Awadzi, 1975).

Amantin Series: (*Botanpeni*) is deep imperfectly drained, porous and medium textured. It is moderately well supplied with organic matter although it has fairly low plant nutrient reserves. Owing to its sandy texture the soil is susceptible to drought. On the other hand, in years of exceptionally high rainfall it may be partially saturated with water. However, as the soil is deep, free of concretions and gravel and can be easily cultivated, it may be readily used for maize and other crops listed under Ejura Series although yields can be expected to be low. The low natural fertility requires that the soil be manured periodically. As it is susceptible to severe erosion the soil requires more protection from this hazard than **Ejura Series**.
Dentenso Series (*Botanpeni*) is poorly drained and subject to seasonal waterlogging or flooding for varying periods but generally becomes droughty during the dry season. Because of the

very low clay content, very low crop yields may be expected from this soil. By establishing interceptor drains, maintenance of organic matter and the use of adequate fertilizers, rice, tobacco and vegetables may successfully be grown on **Dentemso Series.**

Farmers' Appraisal of Agronomic Value of the Major Soils

Farmers appraisal of the agronomic values of the soils is greatly influenced by the major staple food of the people as well as the major cash crop that is produced in the area.

In the Nanumba area, millet and sorghum are the most important staples. However, because of the emerging cash crop economy in the area every piece of land is valued first, on the basis of its suitability for yam cultivation. The farmers identify the agronomic values of the soils by using colour and indicator plants.

The Nanumba farmers rank ***Tandanze*** soils as suitable for the cultivation of yams. However, they contend that in times of exceptionally heavy rains, the soils are washed away from the mounds because of its high content of coarse gravels. Where land is available for yams, they recommend that these soils be cultivated to sorghum, millet and vegetables to reduce soil erosion. Farmers identify this soil by ***Aristida Kerstinga*** as the major indicator plant and also by its high loose concretions.

The farmers identify ***Batampeni*** by its 'grey' colour. Farmers contend that, though soil-moisture relationship is poor, they give high yields in the first year after which fertility declines rapidly. Batampeni Soils are not suitable for yam cultivation but vegetables are recommended especially at the end of the rains.

Bihigu soils are the most preferred soils for the cultivation of rice and many other crops. These soils are identified by the existence of prima grass and by its colour.

Bayagri (***Sene*** series) soils which are valley bottom soils, clayey and liable to waterlogging in the rainy season are not very common in the area. These soils are not ranked as an important soil in terms of yam cultivation. Farmers use it for rice and vegetables.

Taeringa Soils (Wenchi Series) are not used by farmers for the cultivation of any crop. They are left as pasture land. This is because these soils are shallow and unproductive.

Discussion

Farmers in the Nanumba area were completely unaware of the scientific classification of the soils of the area, and being illiterate it is unlikely that they will ever be able to understand let alone use the scientific terms of the soil scientist.
However, comparing the classification of the soil scientists with that of the traditional farmer in the Nanumba district it is clear that in general both identify the same types of soils. The

traditional farmer is, however, unable to give definite soil boundaries and in some instances includes parts of one soil group in the other. For instance some farmers confused the shallow phase of Techiman series (*Tandanze* Soils) with Wenchi Series (Taeringa soils). But this is a problem that soil scientists face in their work and the traditional farmers should not be blamed.

Whilst the soil scientists' interpretation of the agronomic value of the soils is based entirely on the ranges of possibilities offered by the soils and climate, the traditional farmers use, in addition to the above, the culture of the area. Hence, in the Nanumba area the agronomic value of the soil is geared towards the production of their staple food crops and in recent years towards the cultivation of yams, the major cash crop.

For food production to be increased soil, scientists and extension officers must be very conversant with farmers perception of the soils. This, added to their own scientific knowledge, will put them in a better position to advise farmers on more efficient use of the soils.

The perception of the traditional farmer should not be ignored for it is based upon years of experimentation and trial and error and this makes whatever they do now scientific. They only need to benefit from the existing advanced scientific knowledge of soil science.

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