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44989

*GHANA DIVISION OF AGRICULTURE*
*SOIL AND LAND-USE SURVEY BRANCH*

formerly

**GHANA DEPARTMENT OF AGRICULTURE**
**DIVISION OF SOIL AND LAND-USE SURVEY**

TECHNICAL REPORT NO.33

RESTRICTED

# REPORT ON THE DETAILED SOIL SURVEY OF WENCHI AGRICULTURAL STATION WENCHI-SUNYANI DISTRICT, ASHANTI

by

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**KUMASI**

1959

GP/W12739/10,000/5-58

GHANA DIVISION OF AGRICULTURE,
SOIL AND LAND-USE SURVEY BRANCH

# Report on the Detailed Soil Survey of Wenchi Agricultural Station, Wenchi-Sunyani district, Ashanti

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# PART I: GENERAL

## Introduction

The soil survey of Wenchi Agricultural Station was commenced on 6th January, 1958, and completed on 4th February, 1958. Its purpose was to examine and classify the soils of the station and correlate them with soils also developed over Upper Voltaian sandstones in areas already examined in northwest Ashanti, Gonja and South Mamprusi.

The day-to-day progress of the survey was under the supervision of Mr. J.T. Ama, Assistant Soil Survey Officer Grade II, with one Assistant Soil Survey Officer, Grade II, three Leading Field Assistants and two Soil Grinders to assist. The survey was under the general charge of Mr. A.R. Stobbs, Soil Survey Officer.

Wenchi lies in northwest Ashanti in latitude 07° 44' N and longitude 02° 07'W, some 95 miles north-north-west of Kumasi. The station lies about 2 miles beyond Wenchi town centre on the east side of the road to Bamboi and encloses an area of some 900 acres in an irregular but roughly square shape (See Map 1).

The methods of survey used were those normal for a Semi-detailed survey, modified slightly to accord with the conditions on the station. Traverses were cut 10 chains apart and sampled at 5-chain intervals. Intermediate check lines were recorded as necessary. A total of 338 chisel holes and fourteen profile pits were dug and 1,418 chains of traverse line were cut.

## Climate

Wenchi lies just within the northern limit of the equatorial climatic zone with its twin rainfall maxima. There are well defined rainfall peaks in May-June and September-October with the main dry season usually commencing about mid-November and lasting to late March. As is to be expected from the location of Wenchi near the limits of this climatic zone there are rather wide variations within the general pattern. Table 1, p.2, listing the rainfall for the three successive years 1954-56 clearly indicates this. The dry months of November to February,

## TABLE 1

## WENCHI

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1954 | 0.20 | 1.98 | 3.99 | 6.13 | 7.12 | 6.19 | 7.15 | 0.96 | 6.34 | 13.59 | 2.20 | 0.04 | 55.89 |
| 1955 | 0.21 | 2.93 | 5.68 | 4.30 | 9.05 | 11.29 | 6.35 | 0.78 | 6.93 | 6.14 | 4.61 | 1.69 | 59.96 |
| 1956 | 0.01 | 3.19 | 2.34 | 4.98 | 8.31 | 3.45 | 1.20 | 1.01 | 6.08 | 5.20 | 2.22 | 1.90 | 39.89 |
| 34-year Average | 0.27 | 1.77 | 3.40 | 5.71 | 6.97 | 8.29 | 3.72 | 2.61 | 7.90 | 8.96 | 3.21 | 0.67 | 53.48 |

Monthly and average rainfall for Wenchi for 1954-56. Obtained from British West African Meteorological Services. Monthly summary of rainfall in the Gold Coast. 1954-56.

## TABLE 2

| STATION AND HEIGHT IN FEET | | | DRY SEASON | | | | | WET SEASON | | | | | | | No. of Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | |
| W E N C H I<br>1,115 | Maximum | Absolute | 91 | 93 | 100 | 97 | 97 | 96 | 94 | 89 | 88 | 88 | 89 | 89 | 4 |
| | | M e a n | 86.9 | 86.8 | 91.4 | 91.1 | 89.9 | 89.4 | 87.5 | 83.4 | 81.1 | 80.6 | 83.4 | 85.0 | |
| | Minimum | M e a n | 69.4 | 67.5 | 67.8 | 70.3 | 71.1 | 70.5 | 70.3 | 69.5 | 68.6 | 68.3 | 69.0 | 68.8 | |
| | | Absolute | 64 | 56 | 57 | 59 | 66 | 65 | 66 | 65 | 65 | 64 | 65 | 64 | |

Mean and absolute monthly temperature in $^{o}F$ for Wenchi. Obtained from B.W.A. Meteorological Services. Gold Coast Monthly weather report. 1953-56.

TABLE 3

| STATION AND HEIGHT IN FEET | Hour | DRY SEASON | | | | | WET SEASON | | | | | | | No of Years |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | |
| W E N C H I 1115 | 0900 | 89.0 | 85.0 | 84.5 | 82.3 | 80.2 | 84.0 | 95.8 | 89.3 | 89.5 | 88.5 | 90.8 | 90.5 | 4 |
| | 1500 | 63.0 | 50.0 | 42.0 | 45.8 | 58.8 | 58.8 | 65.0 | 71.5 | 72.8 | 72.23 | 72.5 | 69.8 | |
| | 2100 | 88.8 | 83.0 | 71.8 | 67.8 | 75.8 | 82.8 | 88.3 | 92.0 | 91.8 | 91.5 | 92.8 | 92.5 | |

Mean monthly relative humidity at 0900, 1500 and 2100 hours for Wenchi. Obtained from B.W.A. Meteorological services. Gold Coast Monthly weather report. 1953-56.

and August, and the rainy months of March, April, May and September show the greatest consistency; June, July and October are very variable. The years 1955 and 1956, as it happens, represent nearly the upper and lower limits of recorded annual rainfall at Wenchi so that, although the seasonal distribution pattern may remain fairly constant, wide annual fluctuations in total rainfall are quite common.

The temperature distribution is much more constant, although the dry season reflects the proximity of the tropical savanna climatic regime in the more pronounced peak in January, February and March, and the marked absolute minimum temperatures recorded during the principal harmattan months of December and January (Table 2, p.3). It is also during these latter months that the relative humidity is at its lowest throughout the day. During the rainy season from June to October it remains uniformly high (Table 3, p.4). No information on evaporation or evapo-transpiration rates is available, but rates will obviously be higher over the grassland-covered uplands than in the forested valleys.

## Geology

The station is sited on Upper Voltaian sandstones almost at the western boundary of the formation. These comprise an unknown thickness of horizontally-bedded, cream and white, feldspathic sandstones. Intermixed with this appear to be some bands of shale, one in particular being found near the spring providing the station water supply.

## Topography

The station is sited in moderately undulating country providing adequate subsurface drainage so that, apart from the bottom soils immediately adjacent to stream beds, only occasional small areas of soils are ever flooded or waterlogged. The countryside here is not so dissected and steeply undulating as is usually the case in areas of Upper Voltaian sandstones at altitudes of 1,000 feet and over (the highest point on the station is about 1,080 feet), consequently rock outcrops characteristic of similar areas elsewhere are here absent. There is one convex summit within the boundaries in the northwest corner, but on the

southwest and southern boundaries the land continues to rise outside the station limits. Hence the general fall of the land is from the higher west side to the river along the east side.

The small river Subin runs from south to north just inside the eastern boundary of the station in a small flat floodplain averaging about 10 chains in width. There are two small left-bank tributaries to this river within the station, both of which run in gulleys (See Map 1).

Water resources

The main source of water supply is from a permanent spring in the bed of the Bede stream near to the station office. Water is pumped from here to various points among the station buildings. Apart from this source, the Subin is a permanent stream, whilst within the Subin's floodplain are a number of small oxbows and ponds which probably retain water throughout the dry season. The majority of the soils being relatively light-textured, subsurface water resources in the soils during the dry season depend very markedly upon variations in the intensity and duration of this season. At the time of the survey, in a dry season with much more rain than usual, all profiles examined clearly retained moisture within a few inches of the surface.

Vegetation and Land Use

The station is sited in an area of derived savanna, with secondary fringing forest and thicket in the valleys. Whilst this is still the broad picture of the station, its care under proper management practices with control of burning and grazing over a period of years has led to certain modifications, especially among the grasses.

Apart from the areas under cultivation, practically the whole of the upland parts of the station are covered by open tall grassland with scattered emergent trees and occasional to frequent stunted shrub-trees. The grassland is almost everywhere dominated by *Imperata cylindrica* (L.) Beauv. in association with various other grasses which may very locally be more numerous than *I. cylindrica* but which

do not have the same ubiquity. The most important of these grasses are: *Andropogon gayanus* Kunth var. *bisquamulatus* Hack, var. *argyrophaes* Staph and var. *genuinus* Hack.; *Beckeropsis uniseta* K. Schum.; and *Panicum maximum* Jacq. Another conspicuous element of the grassland complex is the very distinct zone wholly dominated by *Pennisetum purpureum* Schumach. between the savanna vegetation of the upland areas and the forest-thicket vegetation of the valley bottom.

It is interesting to note that Michelmore (1939), writing of the Belgian Congo grassland, classifies the areas of *Imperata cylindrica (L ) Beauv. var africana (anderss)* C.E. Hubbard, *Panicum maximum* and *Pennisetum purpureum* as secondary grassland formed by destruction of equatorial forest, *Imperata* being especially typical of such areas since it is readily responsive to the moister soil conditions characteristic of the higher rainfall associated with former forest regions.

In that part of the station under cultivation in the west-centre, increasing numbers of short grasses are strongly establishing themselves along the roadsides and in the most heavily grazed fields. *Eragrostis ciliaris* (L.) R.Br., *Eleusine indica* (L.) Gaertn., *Digitaria horisontalis* Willd., *Chloris pilosa* Schum., together with sedges, appear to be establishing themselves at the expense of *I. cylindrica.*

Secondary fringing forest occupies the narrow floodplain of the Subin stream, and is flanked on either side by a belt of thicket. The fringing forest occurs solely over soils of the Tanoso-Chichiwere complex and has the usual 3-storeyed arrangement of the moist semi-deciduous rain forest. Emergents are comparatively rare - *Erythropsis barteri* Ridley sgn., for *Hildegardia barteri (Mast.)* Kostcrm, *Cola gigantea* A. Chev. var *glabrescens* Brenan & Keay, *Ceiba pentandra (L.)* Gaertn. and *Bombax buonopozense* Beauv. are most notable. The shrubby layer is thickly developed, and in the open spaces bordering the stream, grasses are well established. Vegetation and land use have been illustrated in map 2.

List of species found in the three major vegetation units of forest, thicket and grassland are given in Tables 4, 5 and 6, pp. 8-10.

Soils

All the upland soils on the station are developed from Voltaian sandstone. They occupy the whole of the station with the exception of a narrow belt of alluvial

(r) = rare
(o) = occasional
(f) = frequent
(v.f) = very frequent
(d) = dominant

## TABLE 4

## FRINGING FOREST

| TREES | SHRUBS | HERBS | GRASSES |
|---|---|---|---|
| Erythropsis barteri (f) Ridley sgn. for Hildegardia barteri (Mast.) Kosterm.<br>Cola gigantea A. Chev. var glabrescens (r) Brenan & Keay<br>Pterygota macrocarpa (f) K. Schum.<br>Ceiba pentandra (v.f) (L.) Gaertn.<br>Bombax buonopozense (f) Beauv.<br>Turraeanthus vignei (o) Hutch & J.M. Dalz. (Sgn. for T.africanus)<br>Piptadenia africana (f) Hook.f. (Sgn. for P.africanum)<br>Discoglypremna caloneura (r) (Pax) Prain<br>Antiaris africana (v.f) Engl.<br>Ricinodendron heudelotii (f) (Baill.) Pierre ex Pax<br>Albizia adianthifolia (v.f) (Schum.) W.F. Wight<br>Albizia zygia (v.f) (DC.) J.F. Macbr.<br>Albizia ferruginea (r) (Guill. & Perr.) Benth.<br>Albizia glaberrima (r) Benth.<br>Diatemonanthus benthamianus (r) Baill.<br>Terminalia superba (r) Engl. & Diels<br>Pseudospondias microcarpa (f) (A. Rich.) Engl.<br>Pogara xanthoxyloides (r) Lem.<br>Pycnanthus angolensis (o) (Welw.) Warb.<br>Dialium guineense (r) Willd.<br>Triplochiton scleroxylon (o) K. Schum.<br>Spathodea campanulata (d) Beauv.<br>Funtumia elastica (o) (Preuss) Stapf<br>Chlorophora excelsa (o) (Welw.) Benth.<br>Sterculia tragacantha (v.f) Lindl.<br>Trichilia latens (v.f) A. Chev.<br>Carapa procera (f) DC.<br>Cola millenii (f) K. Schum.<br>Uapaca heudelotii (v.f) Baill.<br>Morus mesozygia (o) Stapf.<br>Macaranga hurifolia (r) Beille<br>Cola nitida (r) (Vent.) Schott & En<br>Bridelia micrantha (r) (Hochst.) Baill.<br>Ficus asperifolia (v.f) Miq.<br>Celtis mildbraedii (o) Engl. | Ficus altissima (v.r)<br>Leconiodiscus cupanioides (f) Planch. ex Benth.<br>Monodora myristica (f) (Gaertn.) Dunal<br>Allophylus africanus (r) P.de Beauv. | Alchornea cordifolia (v.f) (Schum. & Thonn.) Müll. Arg.<br>Acacia pennata (v.f) (L.) Willd.<br>Corcestis afzelii (o) Schott.<br>Thaumatococcus daniellii (d) Benth.<br>Culcacia angolensis (v.f) Meln.<br>Marantochloa flexuosa (d) Hutch.<br>Palisota hirsuta (v.f) K. Schum.<br>Costus afer (v.f) Ker. | Centotheca lappacea (o) (L.) Desv.<br>Streptogyna gerontogea (r) Beauv.<br>Paspalum conjugatum (r) Berg.<br>Axonopus compressus (r) P. Beauv.<br>Desmodium adscendens (f) (Sw.) DC. |

( r) = rare
( o) = occasional
( f) = frequent
(v.f) = very frequent
( d) = dominant

TABLE 5

THICKET

| TREES | SHRUBS | HERBS | GRASSES |
|---|---|---|---|
| Ricinodendron heudelotii (v.f) | Lecaniodiscus cupanioides (f) | Hybophrynium braunianum (d) K. Schum. | Digitaria horizontalis. Willd. |
| Albizia zygia (v.f) | Allophylus africanus (v.f) | Aspilia latifolia (v.f) Oliv. & Hiern | Ammocalamus compressus P. Beauv. |
| Albizia adianthifolia (v.f) | Cnestis ferruginea (f) DC. | Clerodendron capitatum (v.f) Schum. & Thonn. | Pseudochinoleena polystachya (H.B.K.) Stapf |
| Anthocleista nobilis (r) G. Don | Phyllanthus floribundus (o) Muell. Arg. | Urena lobata (v.f) L. | |
| Pseudospondias microcarpa (v.f) | Trichilia heudelotii (f.-o) Planch. ex Oliv. | Solanum torvum (o) Swartz | |
| Canthium glabriflorum (o) Hiern. | Voacanga africana (o) Stapf. | Wedelia africana (o) Beauv. | |
| Khaya senegalensis (o) (Desr.) A. Juss. | Dalbergiella welwitschii (v.f) Bak.f. | Costus afer (v.f) | |
| Erythrophlis barteri (f) | Rauwolfia vomitoria (f) Afz. | Pelisota hirsuta (v.f) | |
| Cola millenii (f) | Alchornea cordifolia (d) | Afrosersalisia sceptrum (d) K. Schum. | |
| Antiaris africana (v.f) | Myrianthus arboreus (v.f) P. Beauv. | Blainvillea prieuriana (d) DC. | |
| Mondora myristica (f) | Elaeis guineensis (d) Jacq. | Paullinia pinnata (v.f) L. | |
| Sterculia tragacantha (v.f) | Tessa guineensis (v.f) (Schum. & Thonn.) Ficalho | Desmodium lasiocarpum (f) DC. | |
| Canpa procera (v.f) | Erigeron canadensis (Linn.) | Cardiospermum halicacabum (o) L. | |
| Sterculia tomentosa (o) Guill & Perr. | | Motandra guineensis (v.f) A. DC. | |
| Morus mesozygia (o) | | Erigeron canadensis (v.f) (Linn.) | |
| Spathodea campanulata (d) | | Hilleria latifolia (r) (Lam.) H. Walt. | |
| | | Commelina nudiflora (v.f) Linn. | |
| | | Ageratum conyzoides (v.f) L. | |

(r) = rare
(o) = occasional
(f) = frequent
(v.f) = very frequent
(d) = dominant



## TABLE 6

## SAVANNAH

| TREES | SHRUBS | HERBS | GRASSES |
|---|---|---|---|
| Spathodea campanulata (d) | Cussonia longissima (v.f.) Hutch. & J.M. Dalz. | Afrandrum sceptum (d) | Imperata cylindrica (v.d.) (L.) Beauv. var. africana (Anderss.) C.E. Hubbard. |
| Albizia zygia (f.-o) | Allophylus africanus (v.f.) | Aspilia latifolia (o) Oliv. & Hiern. | Andropogon gayanus Kunth var. bisquamulatus Hack var. argyrophaes (d) Stapf. |
| Ficus asperifolia (f.-o) | Trema guineensis (v.f.-d) | Erigeron canadensis (v.f.-d) | Andropogon tectorum (r) Schum. |
| Blighia sapida (r) Konig | Crossopteryx febrifuga (d) Benth. | Ageratum conyzoides (v.f.-d) | Beckeropsis uniseta (v.f) K. Schum. |
| Spondias monbin (r) Linn. | Antidesma venosum (f) Tul. | Urena lobata (v.f) | Panicum maximum (v.f) Jacq. |
| Sterculia tragacantha (o) | Ficus gnaphalocarpa (d) (Miq.) Steud. ex A. Rich | | Hyparrhenia rufa (r.-o) Stapf |
| Parkia filicoidea (d) Welw. | Sarcocephalus esculentus (d) Afzelius | | Pennisetum purpureum (f) Schumach. |
| Vitex cienkowskii (d) Kotschy & Peyr. | Dalbergiella welwitschii (v.f.) Bak. f. | | Pennisetum polystachyon (f.-o) Schult. |
| Anogeissus leiocarpus (f) (DC.) Guill. & Perr. | Clerodendron capitatum (f) Schum. & Thonn. | | |
| Hymenocardia acida (v.f) Tul. | Fluggea virosa (o) Baill. | | |
| Terminalia sokodensis (v.f.) Engl. | Lophira alata (v.r) Banks ex Gaertn. f. | | |
| Burkea africana (f) Hook. | | | |
| Lannea acida (o) A. Rich. | | | |
| Ceiba pentandra (v.f) | | | |

soils in the floodplain bordering the Subin stream near the eastern boundary. The soils all belong to the Damongo-Akumadan/Tanoso Compound Association of the Upper Tano Basin (Radwanski, 1956) and comprise three distinctive groups of closely related soils: a Simple Association of Wenchi and Techiman series developed over a generally friable layer of ironpan which is itself forming from the ferrugination of decomposing sandstone beds at a relatively shallow depth; downslope occurs a simple association of Damongo and Murugu series developed in local colluvial drift; in the valley bottom occurs Chichiwere-Tanoso alluvial complex.

The shallowness of the soil depth overlying the ironpan horizon is the chief agricultural limitation in the summit soils, especially in Wenchi series which has less than 12 inches of concretionary soil material overlying solid ironpan. In appearance and texture, the profiles bear a close resemblance to the Tongori-Buem- Banbida series which form a Simple Association over Voltaian sandstones in the Gambaga and Damongo areas, and which have been identified with the younger of the two peneplain surfaces in these places. No such geomorphological correlation has been possible about Wenchi, however, and the occurrence of ironpan soils stretching from the summits to the lower slopes, with ironpan of a fresh and immature type, suggests that they belong to a subsequent erosion cycle.

Damongo and Murugu series as identified at Wenchi have a much more restricted range of characteristics than soils of the same name identified during the Upper Tano Basin survey and the Damongo groundnut survey. This is due to the better understanding of savanna soils developed over Voltaian strata that has since been acquired and as used here the profiles are directly comparable to the Mimi and Kambe series respectively as used in the Nasia Basin and Nole-Kulpawn surveys. They are local colluvial drifts with sandy loam topsoils passing down into a sandy clay subsoil before again passing into the sandy loam of the parent material. Damongo series is generally deep, and is a red, well-drained soil. Murugu series is the yellow-brown to pale orange-brown middle-to-lower slope associate. Profiles occasionally include some ferruginised concretionary material derived from adjacent Wenchi and

Techiman soils, but this is never very important quantitatively. It is a noteworthy feature of soils developed over Upper Voltaian sandstones, and their characteristic rolling topography under savanna vegetation, that true middle and lower slope soils are relatively minor constituents of the pedological scenery, and this also applies at Wenchi. Murugu series as established for the Voltaian savanna areas as a whole is a much more markedly yellow-brown soil with more conspicuous subsoil mottling than is the case at Wenchi. For the most part, Murugu series at Wenchi is closer to Damongo series than is the model profile, being essentially a pale orange-brown transitional soil, and only rarely developing any conspicuous mottling. These soils, because of their depth and texture, are potentially the best on the station for cultivation. They have a good rooting depth, are easily tilled, and the application of farmyard manure can further improve their tilth. The moisture relationships are good in the case of Damongo series, but slightly less good in Murugu series.

Associated with the two upland associations are two minor series. The more extensive of these is Tampu series, a colluvial infilling along drainage grooves. It does not differ very greatly from Murugu series, save in its more definitely yellow-brown colour, indicative of a degree of subsoil waterlogging in the rainy season, and its rather more clayey texture. A distinct variant was encountered at one site in which the deep subsoil was heavily mottled with soft rust-coloured concretions which hardened somewhat on exposure thus forming an incipient groundwater laterite. The other is Jensoso series, a soil very similar in appearance to Techiman series, save that, as it occurs on a relatively flat saddle between two low summits where the drainage is relatively impeded, the topsoil is distinctly grey, and the upper subsoil, with abundant large nodular concretions of a kind characteristically associated with groundwater laterites, is of a yellow-brown instead of a reddish brown colour.

The bottom soils of the floodplain along the Subin river comprise two series. Chichiwere series is found developed in alluvial material on levees. It is a grey-yellow loose sand or light loam. Its distribution at Wenchi is in a series of small scattered patches along the present line of the river, and also bounding various small

oxbows and cut-offs. It has therefore been mapped together with Tanoso series as a complex. Tanoso series is a very fine sandy loam over greyish yellow sandy clay which occupies the whole of the flat floor of the flood-plain and occupies over 90% of the complex. The distribution of the soil series mentioned have been shown on map 3 and are systematically described below.

## PART II: SOIL SERIES DESCRIPTIONS

### Wenchi series

This soil consists of a shallow, concretionary, slightly humous topsoil over indurated ironpan within 12 inches of the surface. It is found in small but fairly frequent patches in areas dominated by soils of Techiman series, and seems localised on two sites: on the relatively flat or gently convex summits; and around the lower limits of such areas where it seems that the ironpan frequently occurs closer to the surface before it terminates in a slight but noticeable break-of-slope, giving way to non-concretionary colluvial drifts.

Wenchi series is unsuitable for agriculture, and supports only grassland with scattered stunted trees.

A typical profile is described as follows:

| | | |
|---|---|---|
| Profile No. : | | WAS.1 |
| Site : | | Upper slope, gently undulating |
| Vegetation : | | Open tall grassland |
| 0 to 3½ | inches | Dark greyish brown (10YR 3/2). Humous. Sandy light loam. Occasional to frequent ferruginised rock brash and ironstone concretions. Very rare pan brash. Frequent rootlets. Structureless and loose: pH 6.2 |
| 3½ to 11 | " | Dark brown (10YR 3/2). Slightly humous. Sandy light loam. Abundant ironstone concretions and ferruginised rock brash. Frequent pieces and boulders of pan. Rare angular quartz gravel and small stones. Occasional rootlets. Structureless and loose: pH 6.0 |
| 11 to 30 | " | Massive ironpan with frequent quartz gravel and ironstone concretions: pH not determined. |

| | | |
|---|---|---|
| 30 to 34 | inches | Red (2.5YR 5/6). Sandy light loam. Dominant ironstone concretions and ferruginised rock brash. Occasional quartz gravel and small stones. Rare pan flakes. Rare traces of weathered rock. Structureless. Compact: pH 5.2 |
| 34 to 44 | " | Light red (2.5YR 6/6). Sandy light loam. Abundant pieces and brash of ferruginised and slightly ferruginised rock. Occasional traces of weathered sandstone. Structureless. Slightly compact: pH 5.0 |
| 44 to 61 | " | Reddish yellow (5YR 6/6). Mottled red and light red. Sandy light loam. Frequent pieces of incipient ironpan. Rare ferruginised sandstone brash. Frequent traces of weathered sandstone. Structureless and slightly loose: pH 5.0 |
| 61 to 89 | " | Reddish yellow (5YR 7/6). Mottled pinkish white and red. Loamy sand. Occasional pieces of incipient ironpan. Abundant traces of weathered sandstone. Structureless. Loose: pH 5.0 |
| 89 to 96 | " | Decomposing sandstone. Rare pieces of incipient ironpan. Structureless and loose: pH 5.0 |

Moisture relationships.- Wenchi soils tend to be waterlogged at the height of the rainy season but become very droughty during dry periods.

Cultivation characteristics.- The shallow and concretionary nature of the topsoil make these soils unsuitable for cultivation.

Nutrient status.- Nutrient supplies are likely to be contained entirely in the topsoil organic matter and to be very low.

Techiman series

This is the dominant member of the Wenchi-Techiman Simple Upland Association. Like Wenchi series it is a reddish concretionary soil overlying ironpan, but it differs from the former in that the ironpan horizon is encountered only at depths greater than 12 inches. It is also less common to find the upper part of the ironpan horizon forming a hard crust; it typically takes the form of very compact but friable ferruginised sandstone brash passing slowly downwards into ironstained weathering sandstone.

A typical profile is described as follows:

| | | |
|---|---|---|
| Profile No. : | | WAS. 9 |
| Site : | | Middle to upper slope, gently undulating |
| Vegetation : | | Open tall grassland with trees |
| 0 to 4 | inches | Dark reddish grey. (5YR 4/2). Humous. Crumbly and porous. Fine sandy light loam. Rare ironstone concretions, very rare angular quartz gravel, very frequent rootlets: pH 5.8 |
| 4 to 111 | " | Reddish brown. (5YR 4/3). Humous. Structureless and porous. Fine sandy light loam; occasional ironstone concretion. Rare to occasional ironpan brash, very rare small subangular quartz stones: pH 5.4 |
| 11 to 23 | " | Reddish brown. (5YR 4/4). Structureless and porous. Sandy clay. Very frequent ferruginised sandstone brash and ironstone concretions plus slightly ferruginised rock trash; rare ironpan brash. Rare root fibres: pH 5.0 |
| 23 to 40 | " | Yellowish red. (5YR 4/6). Structureless and porous, sandy light clay. Abundant decomposing sandstone brash, ferruginised rock brash and ironstone concretions. Very rare root fibres: pH 6.0 |
| 40 to 53 | " | Yellowish red (5YR 5/6), porous and structureless, sandy light clay. Very abundant decomposing brash of sandstone, occasional ironstone concretions and ironpan brash. Occasional root fibres: pH 5.0 |

Moisture relationships.- The soil is permeable throughout despite the compactness of the pan layer and both external and internal drainage are good. The soils dry out specially in the dry season.

Cultivation characteristics.- This soil is the one which is most used on the station for cultivation. Radwanski (1956), commenting on the series in the Upper Tano Basin, recommends its use only for protective belts of vegetation. The concretionary nature of the topsoil and the proximity of the pan layer to the surface provide adverse conditions both for mechanised tillage and root growth, and as in Wenchi series, there is always present the danger of topsoil erosion leading to the irreversible hardening of the pan layer.

Nutrient status.- The profile is moderately to very acid in reaction throughout, the pH decreasing through the topsoil and generally remaining steady throughout the subsoil. Nutrients are concentrated in the topsoil organic matter. Reserves are likely to be low and nitrogen and phosphorus are likely to be markedly deficient for satisfactory crop production.

Jensoso series

This is a minor soil series closely related to Techiman series. It occurs over an ill drained upland site in a saddle between two rounded hill crests.

The profile consists of about one foot of relatively concretion-free, grey, fine sandy loam topsoil over a ferruginous horizon developing in weathering sandstone. The upper part of this ferruginous horizon — 18 to 30 inches thick — consists of irregularly-shaped ferruginised sandstone fragments tightly packed in a brown, fine sandy clay matrix. Below this there is a zone of brightly mottled, indurated weathering sandstone.

A typical profile is described as follows:

| | | |
|---|---|---|
| Profile No.: | | WAS. 14 |
| Site | : | Middle slope, gently undulating |
| Vegetation | : | Close short grassland amongst open tall grassland. |
| 0 to 7 | inches | Greyish brown. (10YR 5/2). Humous. Fine sandy light loam. Very rare small ironstone concretions. Frequent rootlets. Slightly crumbly and porous: pH 5.4 |
| 7 to 13 | " | Brown (10YR 5/3). Slightly humous. Fine sandy clay. Occasional ironstone concretions. Very rare ferruginised rock brash. Occasional rootlets. Structureless and slightly firm: pH 5.2 |
| 13 to 20 | " | Brown (7.5YR 5/4). Fine sandy clay. Very frequent ironstone concretions and ferruginised rock brash. Very rare ironpan fragments and slightly ironstained sandstone brash. Rare rootlets. Structureless and compact: pH 5.2 |
| 20 to 30 | " | Reddish brown (5YR 5/4). Sandy clay. Abundant small and large ironstone concretions and ferruginised rock brash. Rare ironpan fragments. Very rare quartz gravel and sandstone brash. Rare rootlets. Structureless. Slightly compact: pH 5.2 |

| | | |
|---|---|---|
| 30 to 42 | inches | Reddish brown (5YR 5/4). Sandy light loam. Very abundant ironstone concretions and ferruginised rock trash. Very rare sandstone trash and quartz gravel. Very rare traces of decomposed sandstone. Structureless. Slightly loose: pH 5.0 |
| 42 to 58 | " | Reddish yellow (7.5YR 7/6) and yellow (2.5YR 8/6) mottled red (2.5YR 5/6). Sandy light loam. Very frequent ironstone concretions and ferruginised rock trash. Rare pieces of ironstained decomposing sandstone. Structureless and indurated: pH 5.0 |
| 58 to 72 | " | Reddish yellow (7.5YR 7/6) and yellow (2.5YR 8/6) mottled red (2.5YR 5/6). Sandy light loam. Occasional ironstone concretions. Traces of decomposed sandstone. Structureless and slightly indurated: pH 5.0 |
| 72+ | " | Decomposing sandstone. Structureless and slightly loose: pH 5.0 |

Moisture relationships.- This soil is waterlogged in the rainy season, and the subsurface drainage is slow.

Cultivation characteristics.- The soils are little suited to cropping in comparison with other soils on the station. The depth of soil above the concretionary horizon is shallow (usually a foot or less), and the moisture relationships are unsuitable for most crops, though upland rice is a possibility.

Nutrient status.- The reaction is very acid throughout the profile, but otherwise the nutrient status is likely to be very similar to that of Techiman series.

Domongo series

This soil is a local colluvial drift derived from Upper Voltaian sandstone and developed on gentle piedmont slopes between the summits and lower slopes. On the Agricultural Station at Wenchi it is second only to Techiman series in areal extent. It normally overlies relatively little weathered sandstone at depths between 3 and 12 feet, but there may be a zone of soft weathered rock above unweathered bedrock and sometimes there is a stone-line of ironstone concretions near the base of the profile.

The profile normally consists of about one foot of brown sandy loam topsoil over a subsoil of variable depth the upper part of which characteristically has a heavier texture — usually light clay or clay — than the lower part.

A typical profile is described below:

| | |
|---|---|
| Profile No.: | WAS 4. |
| Site : | Middle slope, gently undulating |
| Vegetation : | Open tall grassland with scattered trees. |
| 0 to 3 inches | Dark reddish grey (5YR 4/2). Humous. Fine sandy light loam. Abundant rootlets. Slightly crumbly. Loose: pH 6.0 |
| 3 to 14 " | Reddish brown (5YR 4/3). Fine sandy light loam. Occasional rootlets. Structureless. Porous: pH 5.6 |
| 14 to 21 " | Reddish brown (2.5YR 4/4). Fine sandy light clay. Rare minute ironstone concretions. Rare rootlets. Structureless. Porous: pH 5.0 |
| 21 to 29 " | Red (2.5YR 4/6). Fine sandy light loam. Rare rootlets. Structureless. Slightly firm: pH 5.0 |
| 29 to 40 " | Red (2.5YR 4/6). Fine sandy light loam. Structureless. Firm: pH 5.0 |
| 40 to 51 " | Red (2.5YR 4/6). Fine sandy light loam. Structureless. Firm: pH 5.2 |
| 51 to 64 " | Red (2.5YR 4/6). Fine sandy light loam. Structureless. Firm: pH 5.4 |
| 64 to 77 " | Red (2.5YR 4/6). Fine sandy light loam. Structureless. Firm: pH 5.2 |
| 77 to 92 " | Red (2.5YR 4/6). Fine sandy light loam. Structureless. Firm: pH 5.4 |

Moisture relationships.- Both internal and external drainage are good. The soils becomes droughty in the topsoil during dry spells but apparently retain moisture satisfactorily in the subsoil.

Cultivation characteristics.- Uniformity of depth and texture, the gently undulating relief and the porosity of the sandy soil combine to make this an attractive soil for agriculture. It lends itself readily to mechanised agriculture being without rock outcrops or stones in the

profile; the rooting qualities are good, and the tilth and nutrient status of the soil can be easily improved by the application of farmyard and artificial manures.

Nutrient status.- Topsoils are slightly acid in reaction but the subsoil is very or highly acid. Nutrient reserves are likely to be low and nitrogen and phosphorus are likely to need adding for satisfactory crop production. The addition of organic matter, particularly farmyard manure, is desirable on these soils.

Phases.- A thicket phase has been recognised where the soil occurs under thicket vegetation. The different vegetation leads to an increase in humus and to a better crumb structure in the topsoil.

Muruzu series

This is the slightly less well drained associate of Damongo series occurring on the middle to lower slopes of the gently undulating topography over the parent sandstones from which it is derived. It is a brown to yellow-brown non-concretionary colluvial drift and the typical profile consists of about two feet of grey-brown or yellow-brown sandy loam over 3-4 feet of brown sandy clay, which in turn is underlain by a variable depth of yellow-brown heavy loam becoming increasingly mottled grey with depth.

A typical profile from Wenchi is described as follows:

| | | |
|---|---|---|
| Profile No. : | | WAS. 12. |
| Site : | | Middle slope, gently undulating |
| Vegetation : | | Thicket. |
| 0 to 4 | inches | Pinkish grey (7.5YR 6/2). Humous. Fine sandy light loam with very frequent rootlets. Slightly crumbly. Loose: pH 5.6 |
| 4 to 14 | " | Very pale brown (10YR 7/3). Fine sandy light loam with occasional rootlets. Structureless. Porous: pH 5.0 |
| 14 to 23 | " | Reddish yellow (7.5YR 6/6). Fine sandy clay with rare roctlets. Structureless. Slightly compact: pH 4.8 |

| | | |
|---|---|---|
| 23 to 36 | inches | Strong brown (7.5YR 5/6). Fine sandy clay with rare rootlets. Structureless. Slightly compact: pH 4.8 |
| 36 to 50 | " | Strong brown (7.5YR 5/8). Fine sandy light clay. Structureless. Firm: pH 4.8 |
| 50 to 66 | " | Reddish yellow (7.5YR 6/6). Sandy heavy loam. Structureless. Firm: pH 4.8 |
| 66 to 73 | " | Reddish yellow (7.5YR 6/6). Sandy heavy loam. Structureless. Firm: pH 4.8+ |
| 73 to 84 | " | Reddish yellow (7.5YR 7/6). Sandy heavy loam. Structureless. Firm: pH 4.6 |

Moisture relationships.- The duller colour of Murugu series as compared with the red of Damongo series indicates its relatively slower internal drainage. By virtue of its site just above the floodplain, this soil receives a good deal of moisture by lateral drainage from soils in higher topographic sites and consequently may be expected to retain moisture rather longer into the dry season than the other upland soils.

Cultivation characteristics.- Murugu series is very similar to Damongo series in this respect.

Nutrient status.- The reaction is moderately acid in the topsoil and highly acid in the subsoil. Nutrient reserves are likely to be low and nitrogen and phosphorus, together with organic matter, are likely to need supplementing for successful crop production.

Phases.- A thicket phase has been recognised for Murugu series which differs from the normal phase only in having a slightly more humous topsoil with a better crumb structure. At Wenchi, in fact, much of the area occupied by this series is under thicket.

Tampu series

This is a deep sandy soil derived from adjacent slopes by colluvial slopewash and found in minor drainage grooves. Its areal extent is never very great, but it occasionally has importance when it is best developed in well defined grooves resembling the 'fadama' of Nigeria, for in such circumstances it is potentially a useful rice soil.

A typical description is as follows:

| | | |
|---|---|---|
| Profile No.: | | WAS. 3 |
| Site | : | Lower slope, gently undulating (drainage groove) |
| Vegetation | : | Open tall grassland. |
| 0 to 3 | inches | Grey-brown (10YR 5/2). Humous. Fine sandy light loam. Frequent rootlets. Structureless and loose: pH 5.8 |
| 3 to 11 | " | Brown (10YR 5/3). Slightly humous. Fine sandy light loam. Occasional rootlets. Structureless and loose: pH 5.8 |
| 11 to 18 | | Brown (7.5YR 5/4). Fine sandy light clay. Occasional vermicular channels. Structureless and slightly firm: pH 5.4 |
| 18 to 24 | " | Brown (7.5YR 5/4). Fine sandy light clay. Structureless and firm: pH 5.0 |
| 24 to 33 | " | Strong brown (7.5YR 5/6). Fine sandy light clay. Structureless and firm: pH 5.0 |
| 33 to 43 | " | Strong brown (7.5YR 5/6), stained yellow (10YR 7/6). Fine sandy light loam. Structureless and firm: pH 5.0 |
| 43 to 60 | " | Reddish yellow (7.5YR 6/6), mottled yellowish red (5YR 5/6). Fine sandy light loam. Structureless and firm: pH 5.2 |
| 60 to 72 | " | Reddish yellow, (7.5YR 6/6), mottled yellowish red (5YR 5/8). Fine sandy light loam with pieces of indurated earth. Structureless and slightly compact: pH 5.2 |

Moisture relationships.- The surface run-off and subsurface drainage from adjoining soils collects in the valleys occupied by this series before draining to the streams and rivers. Consequently it is usually waterlogged in the rainy season. At Wenchi, however, the waterlogging appears to be confined to the subsoil, and the drainage to be slightly more rapid than is normal. This is probably due to the soil being developed in a groove with a gradient steeper than is usually found associated with Tampu series.

Cultivation characteristics.- The soil is deep, concretion-free and porous, and can be tilled easily. Bunding would be required for rice cultivation.

Nutrient status.- The soils have a moderately acid topsoil and a highly acid subsoil. Nutrient supplies are likely to be slightly higher than in adjoining upland soils, but nitrogen and phosphorus would still require supplementing for satisfactory crop production.

Variants.- One variant has been noted. In this there is an abrupt change at 21 inches to a mottled subsoil with abundant incipient concretions. On exposure this horizon hardens rapidly to form seepage ironpan.

Tanoso series

This is the major member of the floodplain soil complex. It is developed in transported alluvial parent material composed chiefly of fine sand, but occasionally containing a considerable proportion of silt. It is a grey leached sandy loam over mottled clay, occupying the flat floor of the floodplain.

The following is a typical description:

| | | |
|---|---|---|
| Profile No.: | | WAS. 11 |
| Site | : | Bottom (floodplain) |
| Vegetation | : | Cocoa. |
| 0 to 2 | inches | Greyish brown (10YR 5/2). Humous. Silty-fine sandy light loam with very frequent rootlets. Crumbly and porous: pH 5.0 |
| 2 to 7 | " | Light brownish grey (10YR 6/2). Silty-fine sandy light clay with occasional rootlets. Structureless and slightly porous: pH 4.6 |
| 7 to 16 | " | Light grey (10YR 7/2). Silty-fine sandy clay. Structureless and slightly firm: pH 4.6 |
| 16 to 24 | " | Light brownish grey (10YR 6/2). Silty-fine sandy clay with very rare ironstone concretions. Structureless and firm: pH 4.6 |
| 24 to 42 | " | Light yellowish brown (10YR 6/4), mottled red (2.5YR 5/6) and reddish yellow (7.5YR 6/8). Fine sandy light clay with rare ironstone concretions. Structureless and firm: pH 4.8 |
| 42 to 68 | " | Light grey, (10YR 7/2), mottled brownish yellow (10YR 6/6) and yellowish red (5YR 5/8). Fine sandy light clay. Structureless and firm: pH 4.8 |
| | | (Watertable encountered at 68 inches). |

Moisture relationships.- This is a permeable soil, but is waterlogged or flooded in the rainy season by virtue of its topographic position. It retains considerable subsoil moisture throughout the dry season.

Cultivation characteristics.- The soil is easily tilled, but its problems for the agriculturalist are associated with poor drainage. The cocoa grown on it is largely inferior in quality. The soils could probably better be used for rice or vegetable production.

Nutrient status.- The profile is very or highly acid in reaction throughout. Reserves of all nutrients are likely to be low and complete fertilizers would probably be required for continuous crop production.

Chichiwere series

This is a relatively unimportant soil, forming only a small proportion of the floodplain soil complex. It is developed in alluvial sands deposited as discontinuous patches on levees adjacent to the river course. The profile is composed largely of loose yellow sand though at a depth of several feet this may become firmer and slightly mottled.

The following is a typical description:

| | | |
|---|---|---|
| Profile No.: | | WAS. 6 |
| Site | : | Levee |
| Vegetation | : | Thicket. |
| 0 to 3 | inches | Greyish brown. Humous. Fine sandy light loam. Frequent rootlets. Structureless and loose: pH 4.6 |
| 3 to 8 | " | Very pale brown (10YR 8/4). Fine sand. Occasional rootlets. Structureless and loose: pH 4.4 |
| 8 to 14 | " | Very pale brown (10YR 8/4). Fine sand. Very rare rootlets. Structureless and loose: pH 4.4 |
| 14 to 26 | " | Very pale brown (10YR 8/4). Fine sand. Structureless and loose: pH 4.6 |
| 26 to 36 | " | Very pale brown (10YR 7/4). Fine sand. Structureless and loose: pH 4.6 |
| 36 to 46 | " | Very pale brown (10YR 7/4). Fine sand. Rare small lumps of slightly ironstained sandstone. Structureless and loose: pH 4.8 |

46 to 55 inches — Very pale brown (10YR 8/3), mottled yellow (10YR 8/6). Loamy fine sand. Structureless and loose: pH 5.0

55 to 66 " — Pale yellow (2.5YR7/4), mottled light grey (10YR 7/2). Loamy fine sand. Structureless and loose: pH 4.6

(Watertable encountered at 66 inches).

Moisture relationships.- Being largely loose sand, this soil is well drained internally, but owing to its site may be occasionally flooded in the rainy season. Moisture may be available throughout the dry season at depths of 5 ft. or more.

Cultivation characteristics.- The loose sandy nature of the soil gives it poor root-holding qualities, and the alternation of rainy season flooding followed by very rapid drying pose problems for the agriculturalist. The soils would probably best be used for hand-irrigated vegetable production.

Nutrient status.- Though there is considerable humus in the upper topsoil, the soil as a whole is likely to be very deficient in all nutrients. It is highly to very highly acid in reaction throughout the profile.

## References

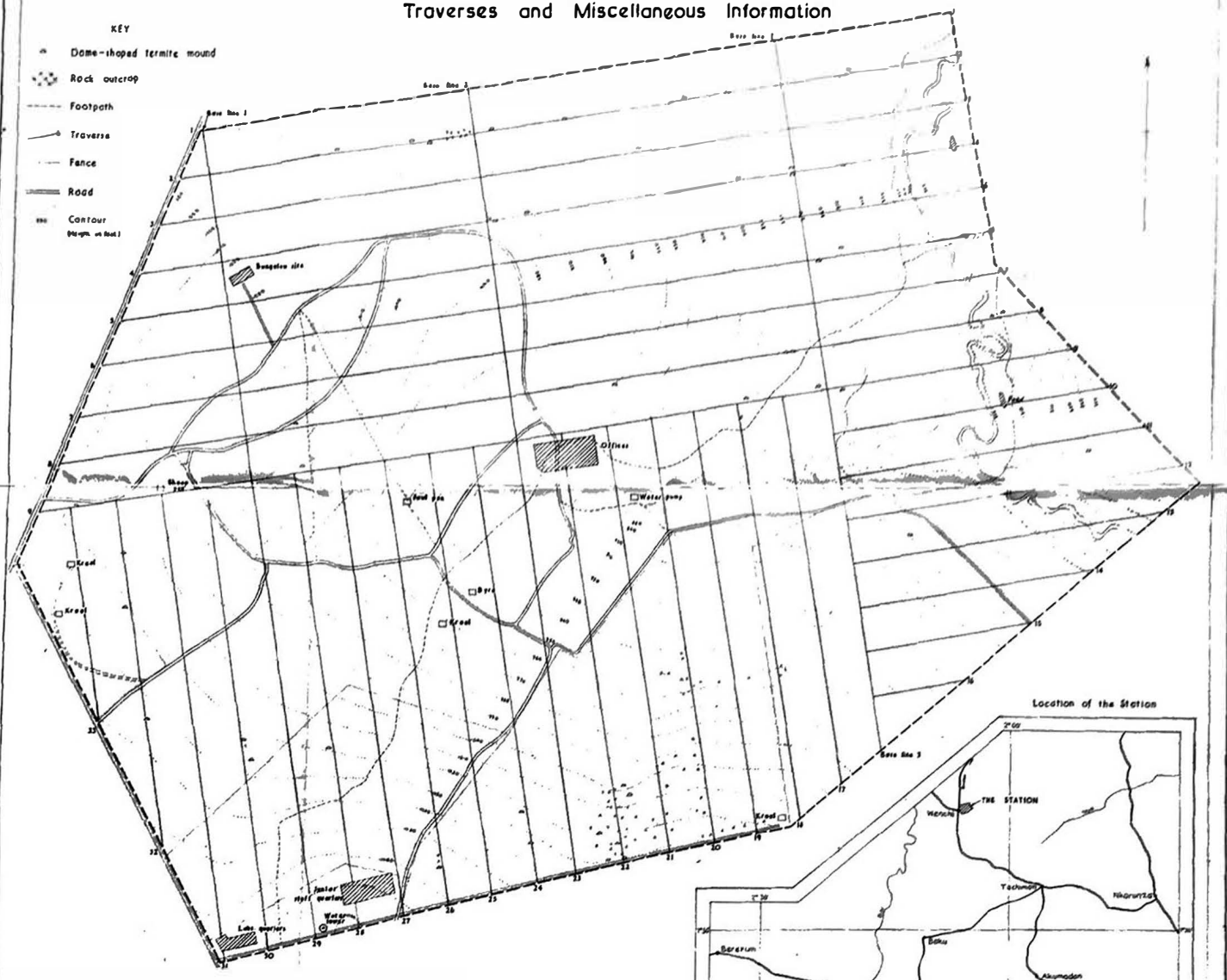
MICHELMORE, A.P.G. 1939. Observations on Tropical African Grasslands. The Journal of ecology, Vol.XXVII, No.2. pp.282-312.

RADWANSKI, S.A. 1956. Report on the Detailed Preliminary soil survey of the Upper Tano Basin. Kumasi, Division of Agriculture, Soil & Land-Use Survey Branch (NS.)

AO:

# WENCHI AGRICULTURAL STATION

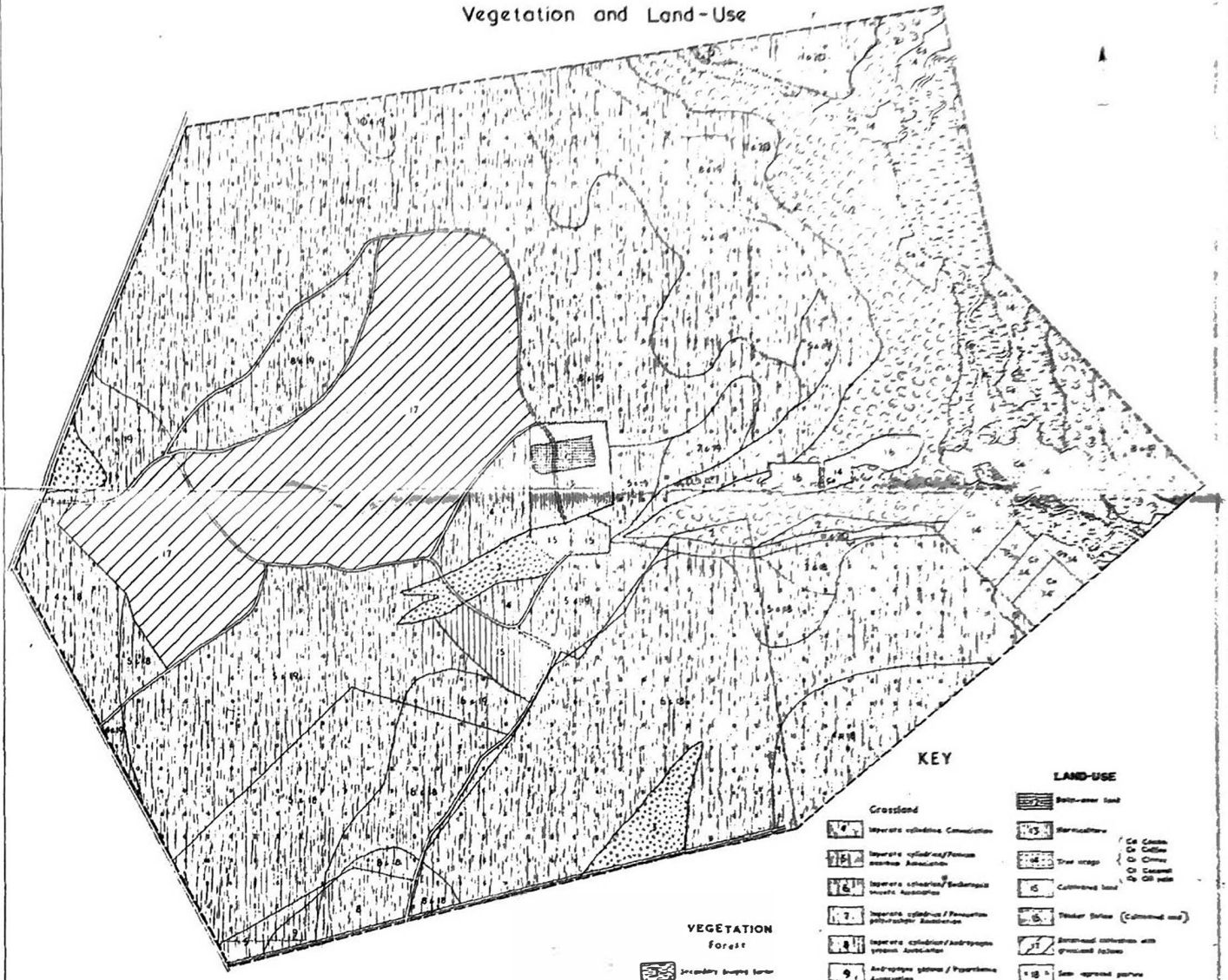
## Traverses and Miscellaneous Information



44788 **Map 2**

# WENCHI AGRICULTURAL STATION

## Vegetation and Land-Use



 Map 3

# WENCHI AGRICULTURAL STATION

## Soils