

Soils and the Production of Cassava in the Llanos Orientales of  
Colombia

R. Howeler

From Nov 27 to Dec. 2 1975 the Llanos Subcenter Logistics Committee made a trip through the Llanos from Puerto Lopez to Caviotas in Vichada and obtained the following information on the subject of soils and cassava production.

Soils

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Geological origin

The Llanos of Colombia is located in the depression between the relatively young Andean mountains and the ancient Guyana shield of Venezuela and Brazil. This depression was gradually filled with sediments during the tertiary and quaternary ages, mostly of Andean origin.

In the quaternary period, during early Pleistocene the Cordillera was uplifted with a simultaneous depression of what is now the Piedmont, Cassanare and Arauca. The Piedmont area subsided to a lesser degree and presented a large number of parallel and transverse faults, resulting in a complex pattern of deposits ranging from early Pleistocene to alluvium of recent origin.

The Cassanare and Arauca area subsided more completely and this subsidence may be continuing to date. This area lies about 30 m. lower than the south and east bank of the Meta river. It is filled with sediments from the late Pleistocene and Holocene forming an alluvial overflow plain. During this time drastic climatic changes occurred, producing in the dry periods windblown sand and loess deposits in the South eastern part of Cassanare.

The early Pleistocene zones on the plains in Meta and Vichada were not covered by new sediments and in areas were subject to intense erosion and dissection resulting in the rugged topography of the "serrania".

### Geomorphology and Land Use

The savannah covered Llanos Orientales can roughly be divided into three major zones each consisting of several soils or geomorphological formations (See Fig. 1).

- 1) Piedmont extending in a strip of 50-100 km width along the eastern flank of the Cordillera to the river Metica (Puerto Lopez). This is also called the "Near Llanos" and is of youngest origin, consisting of a sequence of wide flood plains subject to intensive flooding during the rainy season. It is the most fertile and intensively used part of the Llanos; extensive beef production is more and more being replaced by intensive cattle fattening and commercial crop production such as rice, oil palm, cotton, plantain etc. To the south of Granada the commercial agriculture changes to slash-and-burn agriculture forming a gradual transition to continuous jungle around the Macarena mountains and south of the Guayabera and Guaviari rivers.
- 2) Cassanare and Arauca low plains extending from the Piedmont to the Venezuelan border and from the Meta river in the south to the Arauca river in the north. The area consists partly of alluvial overflow plain and partly of aeolian plain of lighter texture; it has a level topography except for sanddunes in the east. It is characterized by its low elevation and numerous rivers. During the rainy season the watertable rises causing inundation of large areas. During this time land travel is nearly impossible. The area is used for extensive cattle grazing, producing 60-75% of the Llanos beef cattle.
- 3) Meta and Vichada (high plains) extending from the rio Metica in the west to the Venezuelan border in the east, and from the Meta river in the north to the jungle in the south. The savannah jungle-transition follows more or less

the Ariari river to San José del Guaviare, the Guaviari river towards the east, then moving northward following the Vichada river in Vichada.

The area consists mainly of dissected high plains (serrania) in the south and of level high plains and level high plains with poor drainage in the north-east.

The hill landscape of the serrania was produced by severe erosion during various stages exposing in some areas outcroppings of plinthite (hardened laterite). These highly infertile soils have very little agricultural potential besides extensive cattle grazing. The high level plains have a very smooth topography and only gentle slopes towards drainage channels. The bottom part of these slopes are referred to as "bajos" which generally have a higher organic matter content and adequate moisture throughout the year. These "bajos" have some potential for rice production during the wet season, and are very important for producing green pastures for cattle in the dry season. Because of their topography, and the excellent physical conditions of the soils, the high level plains seems to have the most potential for more intensified beef cattle production as well as commercial agriculture once the proper infrastructure and markets have been developed. More over, these are the soils that most resemble those of the Campo Cerrado in Brazil.

Table 1 shows the distribution of landscape areas as given in the 1965 FAO Soil Survey of the Llanos Orientales (1). The survey area included most of the savannah-covered Llanos with the exception of south-east Meta and Vichada. If the latter area had been included, then the area under high plains would have increased to 45-50%. Of these at least 2/3 is "serrania" (Fig. 1). The level high plains are found in a narrow strip (10-20 km width) south of the

Meta river between Puerto Lopez and Puerto Gaitan, and in a wider strip (50 km) east of Puerto Gaitan.

#### Soil fertility

Throughout the Llanos soil fertility is very low because of the inherent low fertility of the parent rock (mainly sandstone and shales) of the Cordillera Oriental from which they are derived. Though highly variable, soils in the Piedmont are generally of higher fertility than those in the outer Llanos. The alluvial overflow plains of Cassanare are also considered a little more fertile than those of the high plains.

Soil fertility in the high plains is fairly uniform, varying slightly with soil texture. Table 2 shows analyses results of samples taken during the trip. In general the light-textured soils (#5,8,9,12,13) are low in organic matter, low in Al, Ca, Mg, K, resulting in an Al-saturation percentage almost equal to that of heavier soils. The only exception is "El Piñal" which is low in Al, but relatively high in Ca, Mg and K. Being close to the river this is not very representative of the high plains. Soil pH varied from 4.1 to 5.0, being negatively correlated with Al.

It can be seen that the Carimagua soil is quite representative of soils of the high plains, and within the farm one can find about the same variability as that found among the Llanos farms. The San Antonio-farm, situated in the serrania has light-textured soils, but otherwise is similar to farms in the level high savannah.

#### Cassava Production

Of the 24 farms visited between Pt. Lopez and Caviotas, 12 farms had some cassava growing near the house for home consumption. Only one small farm

produced cassava for sale in the Puerto Lopez market.

When asked most farmers responded not to have problems with diseases but field observation generally indicated the presence of CBB (6 farms), superelongation (5 farms) and Cercospora (2 farms, of which one very serious). The problem most often mentioned was that of cutter-ants attacking young plantings. Other problems mentioned were stemborers (1 farm) and gallmidgits. The latter was very severe in El Piñal, possibly causing economical losses. The stemborer problem was best treated by benediction according to one farmer! The varieties planted were Chiroso, Algodona (or Paloma), or of unknown origin. The algodona plantings ere generally free of bacteriosis, but had more problems with gallmidgits. One Indian village produced good-looking bitter cassava for preparing casave, the main staple food.

Cassava was generally planted in old corals, in slash-and-burnt gallery forest, or close to a coral to facilitate the application of farm manure. Beautiful cassava was found in the farm of Silvino Caro with the application of cattle and goat manure. Only in San Antonio chemical fertilizers were applied (250 kg basic slag/ha and 15-15-15) and the cassava suffered from severe Mg-deficiency as well as other nutritional problems. In nearly all farms cassava was planted at the onset of the rainy season or throughout the year, harvesting after 10-12 months.

It may be concluded that together with plantain cassava is the most widely grown food crop in the Llanos. Depending on varieties and cultural practices plantations varied from excellent to miserable, CBB and superelongation being the main yield-limiting diseases.

Reference.-

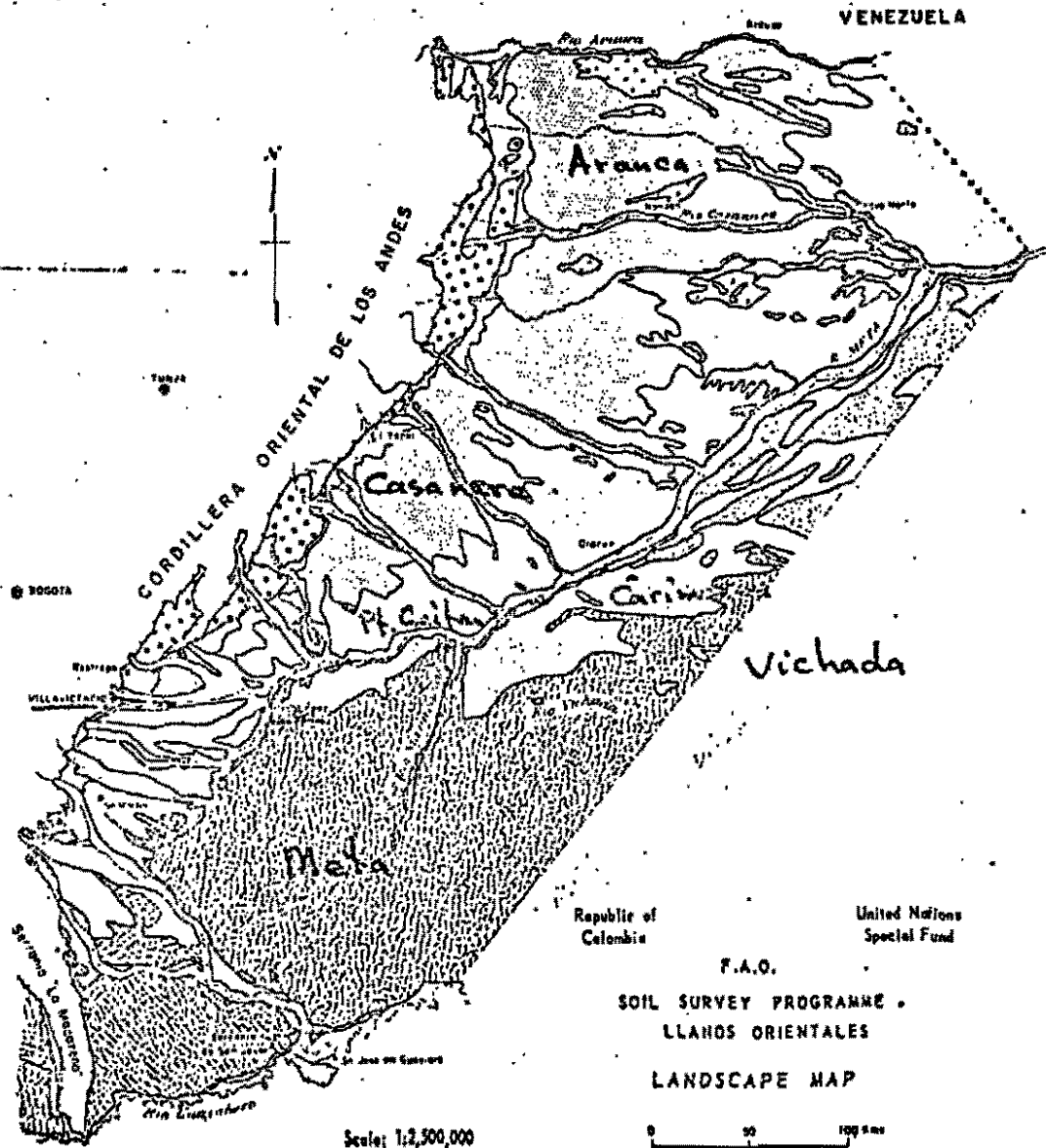
- 1.- Soil Survey of the Llanos Orientales - Colombia UNDP- FAO- Rome, 1965.

**Table 1: Landscape and Soil Distribution and Capability in the Llanos Orientales of Colombia - Adapted from FAO Soil Survey (1)**

	Hectares	Percent	Land Capability Classes
<b><u>Piedmont</u></b>			
Old alluvial fans	353,125	2.8	II, IV
Sub-recent alluvial fans	300,650	2.3	I, II, III, IV
<b><u>Terraces</u></b>	666,861	5.2	II, III, IV
<b><u>Alluvial overflow plain</u></b>	2,950,625	23.0	III, IV
<b><u>Aeolian plain</u></b>	2,076,875	16.1	III, IV
<b><u>Recent alluvium</u></b>	1,286,875	10.0	I, II
<b><u>High plain</u></b>	4,985,625	39.0	III, IV
<b><u>Marshes, awamps</u></b>	210,625	1.6	V
<b>Total</b>	<b>12,831,261</b>		

- \* Class I Land suitable for cultivation - 106,250 hectares.
- Class II Land suitable for cultivation and livestock on improved pastures - 1,566,900 hectares.
- Class III Land suitable for grazing on natural savannas in combination with improved pastures and subsistence agriculture - 3,981,875 hectares.
- Class IV Land suitable for grazing on natural savanna in combination with forestry - 6,750,610 hectares.
- Class V Lands neither suitable for agriculture nor for livestock, recommended for forestation or conservation of forest - 215,000 hectares.

- CONVENCIONES**  
**LEGEND**
- PIEDMONT**
- Old alluvial fans
  - Sub-recent alluvial fans
- TERRACES**
- Alluvial terraces
- ALLUVIAL OVERFLOW PLAIN**
- Alluvial overflow plain
- AEOLIAN PLAIN**
- Dunes
  - Aeolian plain with "escobres"
- ALLUVIUM**
- Recent alluvium
- HIGH PLAINS**
- Level high plains
  - Level high plains with poor drainage
  - Dissected high plains
- Marshes and swamps
- Limit of Cordillera
- International boundary
- Rivers
- Departmental boundary



Republic of Colombia      United Nations Special Fund

F.A.O.

SOIL SURVEY PROGRAMME

LLANOS ORIENTALES

LANDSCAPE MAP

0      50      100 km

1963

Prepared by Doeko Geenen

Fig. I-6

Figure 1. Land scape map Llanos Orientales of Colombia.