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PRELIMINARY STUDIES ON THE WATER ECONOMY IN "CERRADOS"

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R E S U M O

Neste estudo preliminar da economia de água no "cerrado" são apresentados dados de umidade do solo, até uma profundidade de 3 m em áreas de solo nu e em áreas com vegetação natural. As localidades estudadas encontram-se nos municípios de Matão, São Simão e Orlândia, do Estado de São Paulo. Os perfis de umidade do solo são também discutidos em relação à precipitação pluviométrica local.

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SUMMARY

In this preliminary study on the water economy in "cerrado" soil moisture profiles up to a depth of 3 m are shown. The data was collected in bare soil and natural vegetation plots. The studied sites lie in the counties of Matão, São Simão and Orlandia, in the state of São Paulo. The soil moisture profiles are also discussed in relation to local rainfall.

1. INTRODUCTION

Approximately 25% of the total area of Brazil is covered by "cerrados". The first studies carried out in these areas showed interesting problems and, on the other hand, definite possibilities for its use from the agricultural point of view.

Most part of the research carried out deals with soil fertility problems and the basic characteristics of animal and botanical species, as it can be seen in Brazil (2, 3, 4, and 5) and Labouriau and Vanzolini (9). Climate, soil and its relationship to water economy are undoubtless among the basic characteristics whose knowledge is of fundamental importance for the agricultural development of this area. In this sense, little is known and little has been done. Among the main researches made are those of Arens et al.(1), Ferri (6 and 7) and Ferri et al. (8).

The aim of the present work was to make a preliminary study of the importance of water in the soil-plant complex in "cerrados", under natural conditions.

2. MATERIAL AND METHODS

Three "cerrado" areas, of agricultural value and different textural composition were studied in the state of São Paulo:

a. IBEC Research Institute - Matão

b. São Simão Experimental Station (Ministry of Agriculture)

c. Agudo Farm - Orlândia

Two experiments were installed on each site:

a. overgrown soil

b. bare soil (by removing the natural vegetation)

In these areas, of approximately 400 m^2 (20 m x 20 m), determinations of rainfall and soil moisture content up to 3 m depth were made.

The measurement of soil moisture content was made with the help of a probe based on the principle of neutron moderation, furnished by the Danish Isotope Center and especially calibrated for each soil in study. Calibrations were made in the field, collecting soil samples up to 3 m depth to determine the moisture content and density through gravimetric processes; during the study period two calibrations of this kind were made.

The measurement of soil moisture content were made at depths of 28, 33, 53, 73, 93, 143, 173, 243 and 293 cm starting from the soil surface, with intervals of approximately 15 to 30 days and 3 times replicated.

The measurements of rainfall were made with pluviometers 500 cm^2 and 125 cm^2 range, Paulista and Tonnelot types, respectively.

3. RESULTS

Data regarding some soil characteristics of the sites chosen for the experiments are shown in Table I, where,

Depth = depth starting from the soil surface
d_a = bulk density
$\theta_{0,3}$ = volumetric soil moisture content at 0,3 atm tension
θ_{15} = volumetric soil moisture content at 15 atm tension

Figures 1, 2; 4, 5 and 7, 8 show the data regarding the soil moisture content, expressed in g H_2O/cm^3 soil. These are average data obtained from 3 measurements. The total rainfall data expressed in mm and average soil moisture values are presented in Figures 3, 6 and 9.

4. DISCUSSION AND CONCLUSIONS

a. MATÃO

Over the one year period studied the overgrown plot had considerably greater changes in water content. In general, as we can see in figures 1 and 2, soil water contents were very high over the whole period. In the bare plot soil water never reached tensions, below 1/3 atm, and in the overgrown plot tensions slightly below 1/3 atm were observed. This means that water was available for plants over the whole period studied. There is a possibility of a high water table influencing moisture profiles at these sites.

b. ORLÂNDIA

Here little differences can be seen between soil moisture changes in the overgrown and bare plots - Water contents reached high values in the rainy season but also decrease during dry periods to values corresponding to tensions below 15 atm. Water deficiencies for plants during the dry season were certainly present.

c. SÃO SIMÃO

As occurred in Matão, there were differences between moisture content changes between overgrown and bare plots. Water contents never reached very high values. As it can be seen in figures 7 and 8, the tensions were slightly below 1/3 atm over the whole period. Tensions below 15 atm have not been observed so that water has been available over the whole period studed.

5. ACKNOWLEDGEMENTS

To the Conselho Nacional de Pesquisas, International Atomic Energy Agency, Ministry of Agriculture and Fundação de Amparo à Pesquisa do Estado de São Paulo for the financial aid.

To the IBEC Research Institute, São Simão Experimental Station (Ministry of Agriculture) and the Agudo Farm, Orlândia (SP) for the collaboration in the collecting of data, installation and maintenance of the experimental areas.

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TABLE I - Some Physical Characteristics of the Soils

Site	Depth (cm)	bulk density	Clay %	Silt %	Sand %
Matão	0- 40	1,5	17,1	3,3	79,6
	40- 80	1,3	27,9	5,8	66,3
	100-140	1,3	30,1	5,6	64,3
	200-240	-	28,3	4,3	67,0
	280-320	-	21,6	10,4	68,0
São Simão	0- 20	1,3	41,4	15,4	43,2
	30- 50	1,1	-	-	-
	80-100	1,1	-	-	-
	140-160	-	-	-	-
	170-190	-	-	-	-
	270-300	-	-	-	-
Orlândia	0- 20	1,2	60,0	13,2	26,8
	30- 50	1,1	-	-	-
	80-100	1,0	-	-	-
	140-160	-	-	-	-
	170-190	-	-	-	-
	270-300	-	-	-	-

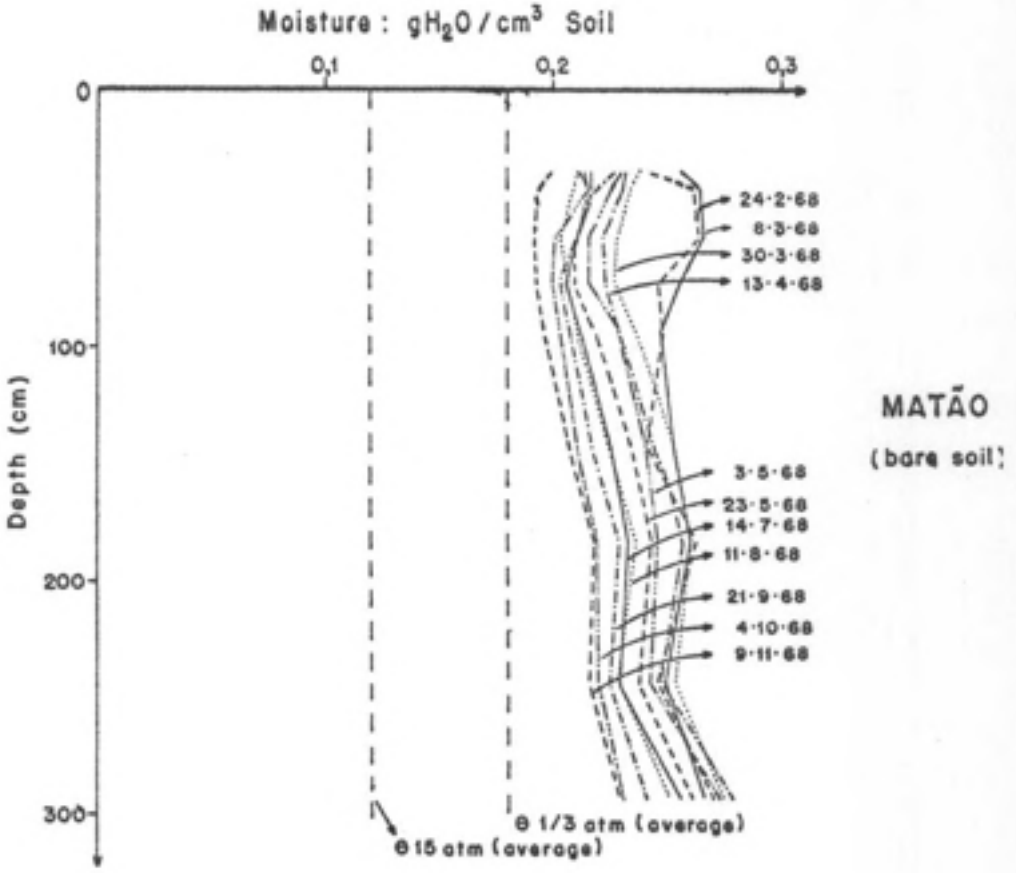

Figure 1 - Soil Moisture Profiles, bare soil, Matão

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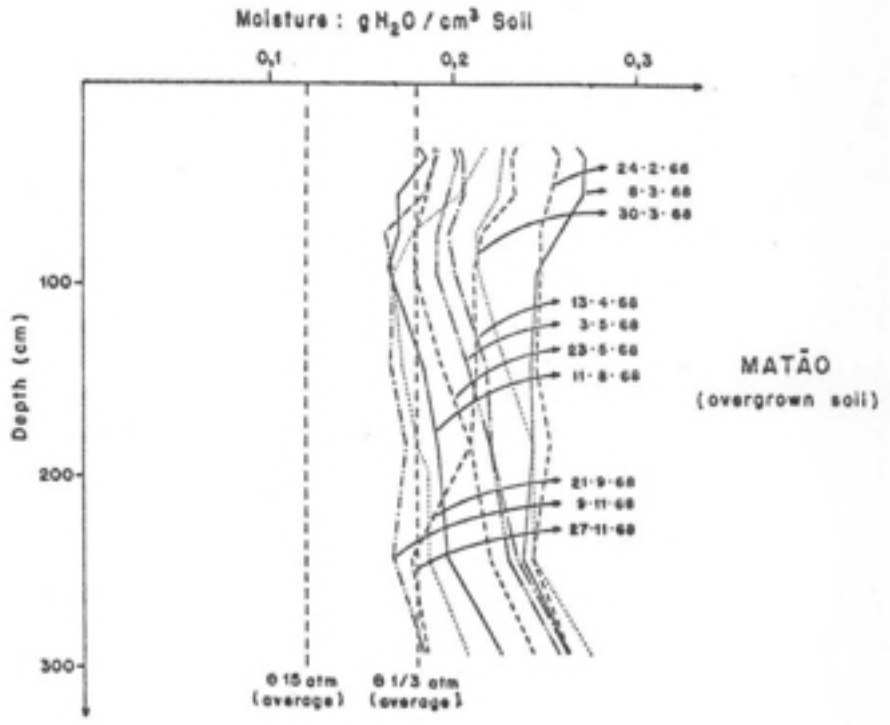

Figure 2 - Soil Moisture profiles, overgrown soil, Matão

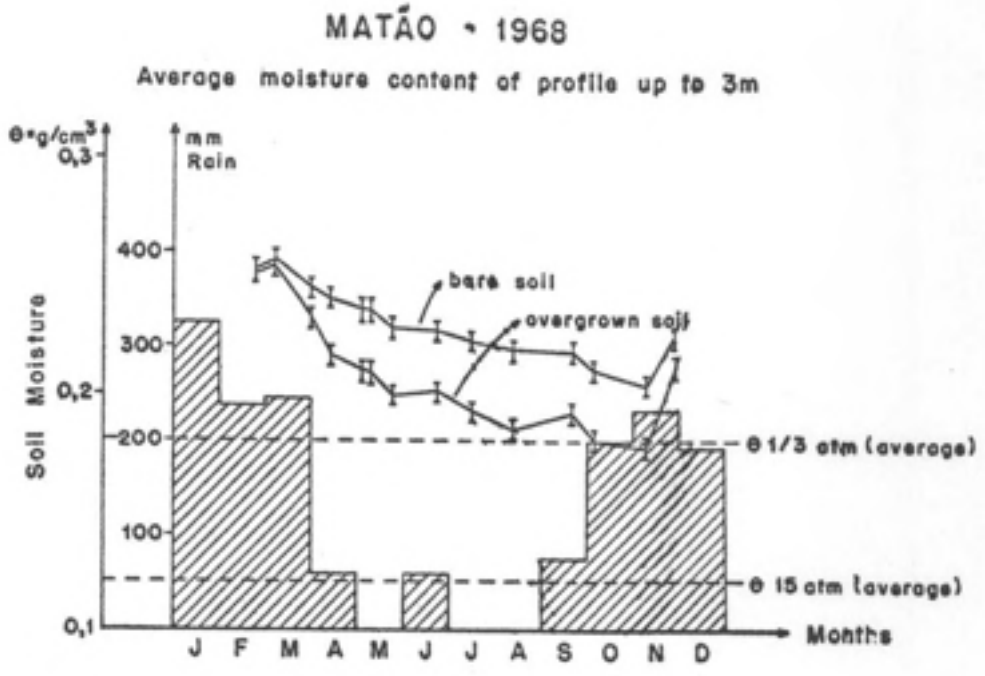

Figure 3 - Average moisture content and rain, Matão

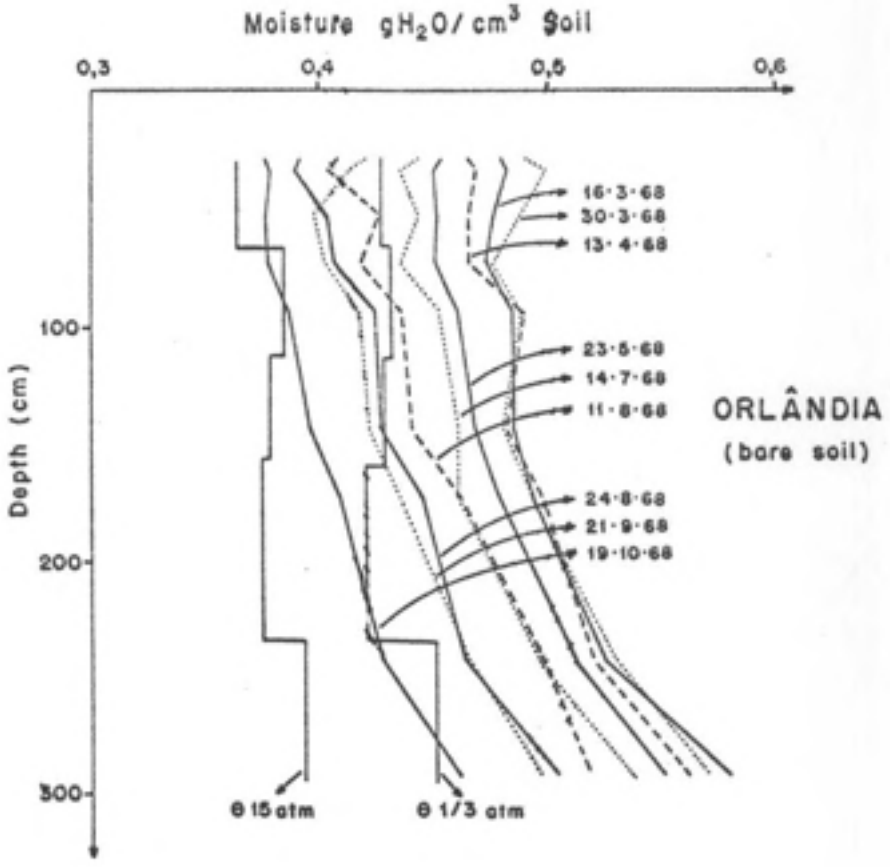

Figure 4 - Soil Moisture Profiles, bare soil, Orlândia

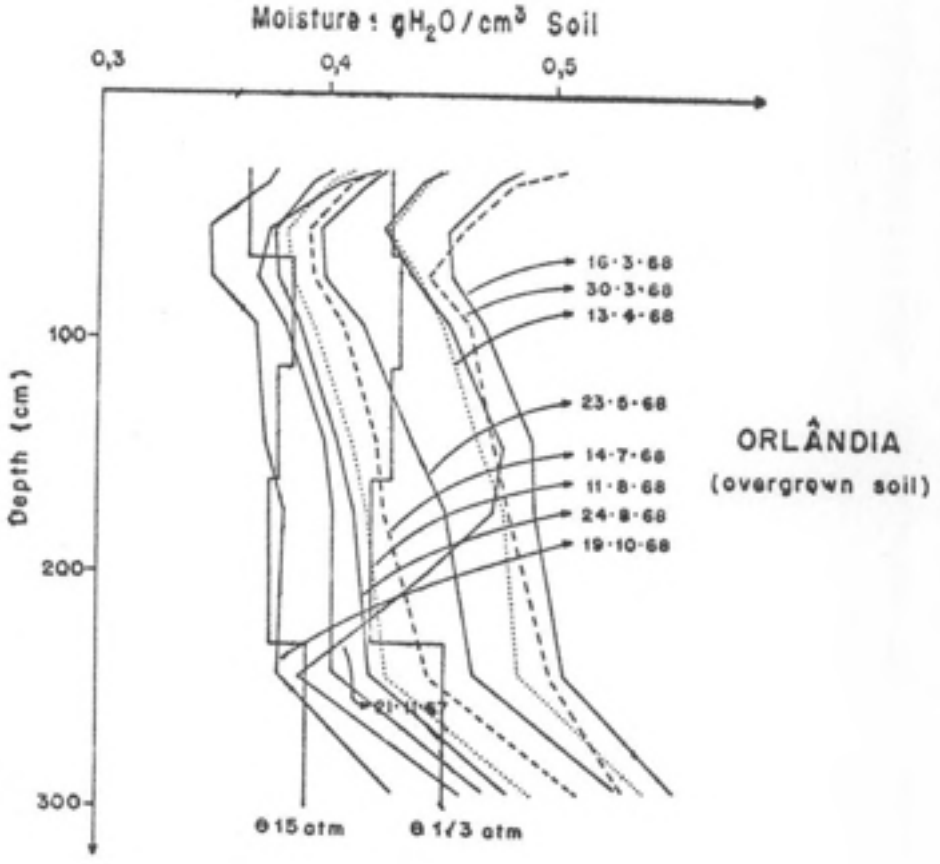

Figure 5 - Soil Moisture Profiles, overgrown soil, Orlândia

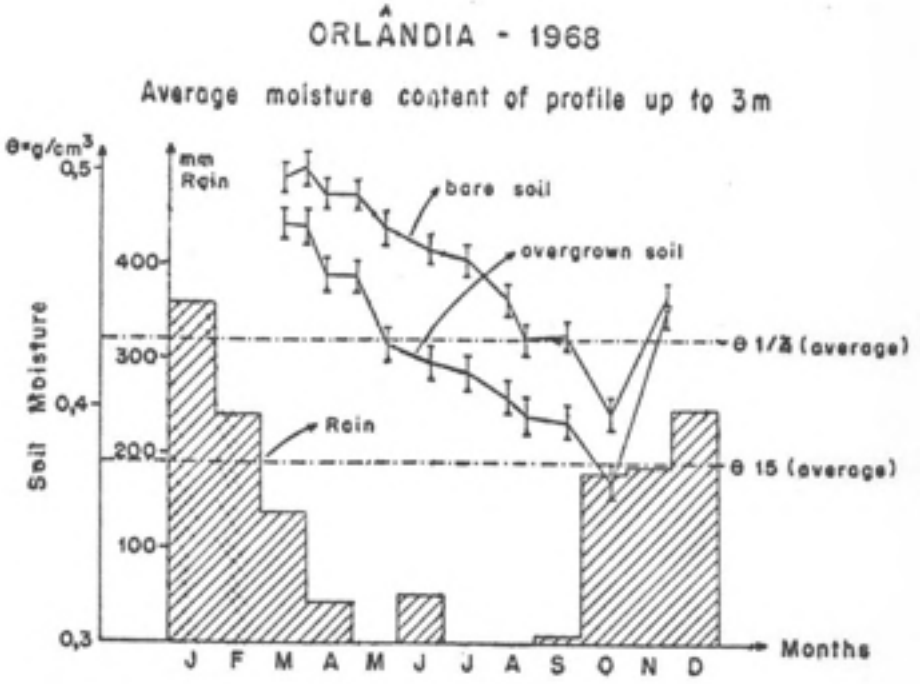

Figure 6 - Average soil moisture content and rain, Orlândia

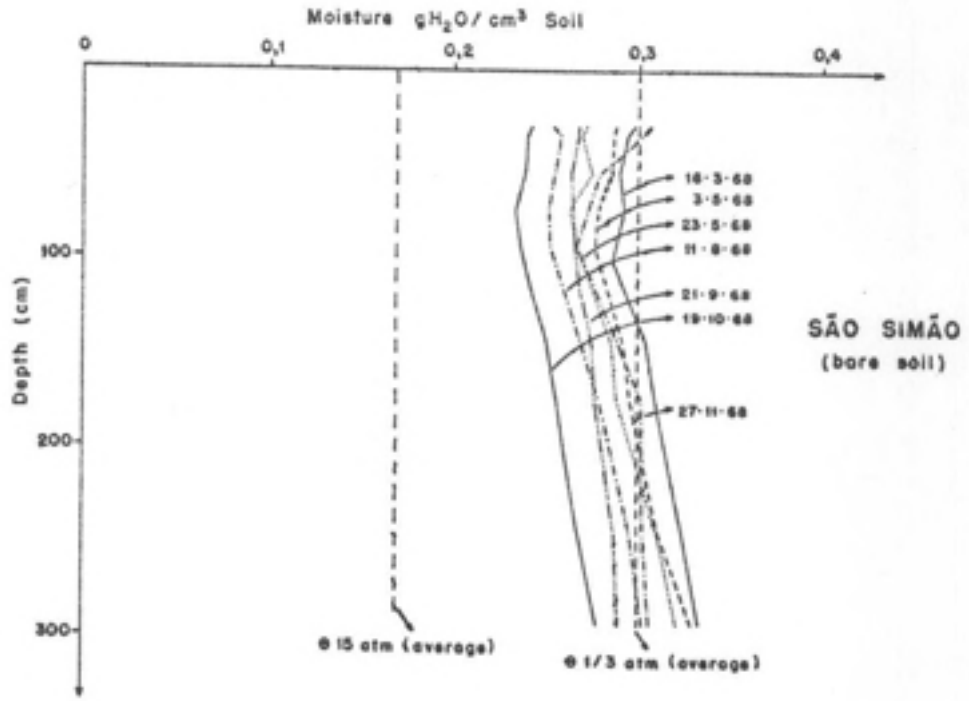

Figure 7 - Soil Moisture Profiles, bare soil, São Simão

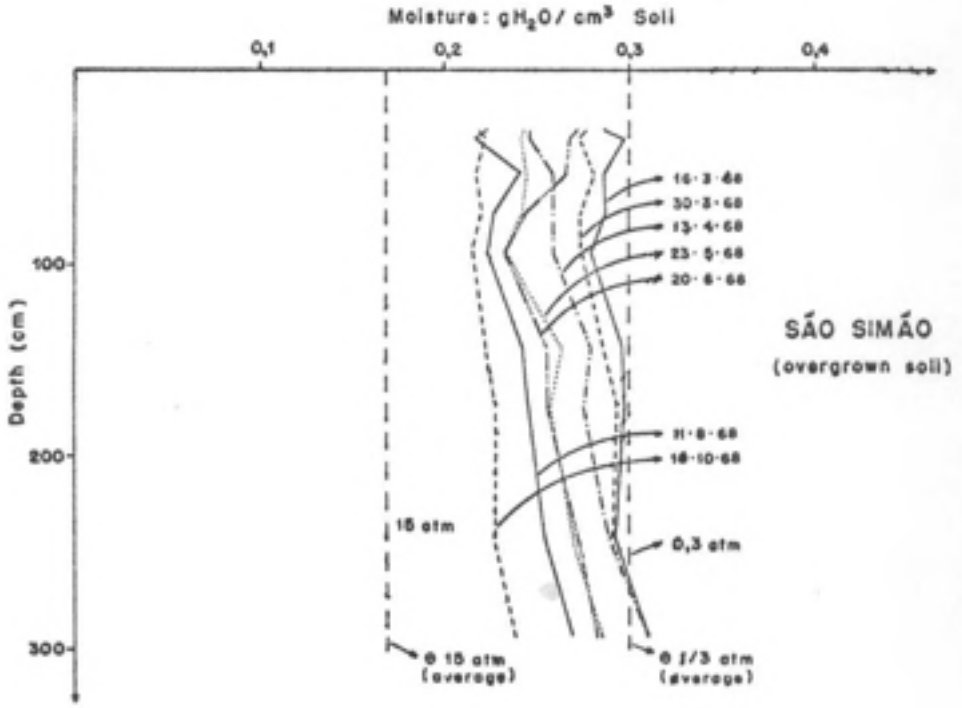

Figure 8 - Soil Moisture Profiles, overgrown soil, São Simão

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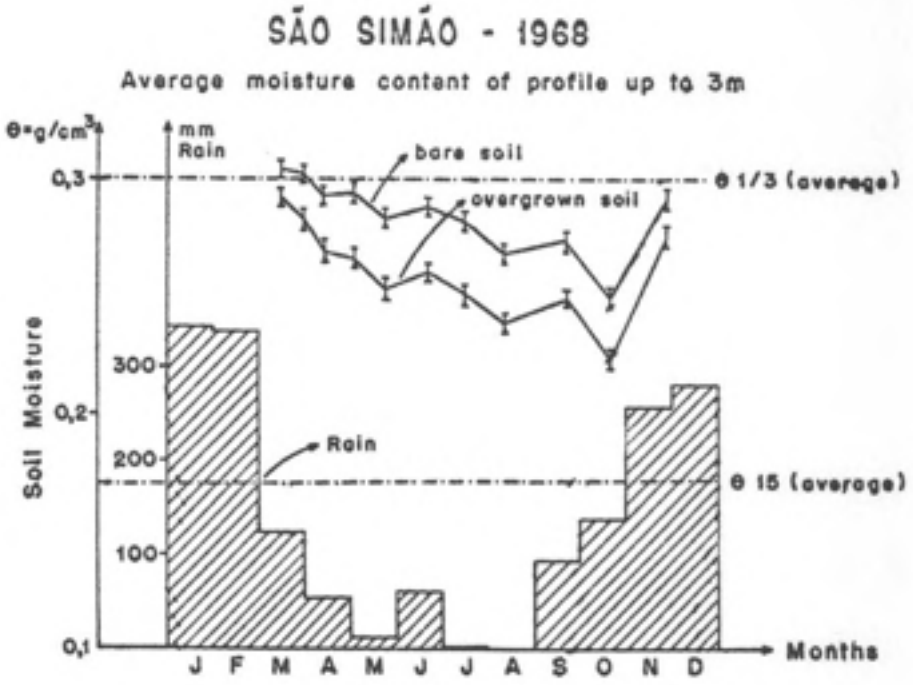

Figure 9 - Average soil moisture and rain, São Simão