RESOURCES SURVEY PROJECT

of the

FRONTIER HOMESTEAD PROGRAM

MINISTRY OF AGRICULTURE, BRAZIL
Project Number 512-15-120-24a

# REVIEW AND EVALUATION REPORT

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CONTENTS

# Summary of Evaluation of Resources Survey Project

1. Good progress as a whole has been made in the Resources Survey Projec since the original agreement was signed on May 30, 1964 despite several difficulties and in fact stoppage of the field work for considerable periods owing mostly to inadequate funding.

2. The resulting schematic soil map and the three interpretive maps together with accompanying text is expected to have a far-reaching influence on the development of Brazil. In fact these four maps, recently printed, are already being used prior to publication of the text, by several agencies in planning for colonization, agricultural development, and locating highways and roads into the interior of Brazil. The release date for the complete publication (maps and text) has been delayed several times for various reasons. It is now estimated that the manuscript will be submitted to the printer by the end of August 1968 with an anticipated release date of December 1968. A concerted effort should be made to speed up this timetable in order to release the publication at an earlier date to meet the urgent demands for this kind of basic information to help guide agricultural development in Brazil.

3. The excellent progress made in 1966 in recruiting and training additional soil scientists was unfortunately and unexpectedly interrupted in 1967 and 1968 owing to inadequate funding. Fortunately, however, plans are being developed to resume the recruitment and training program in 1969.

Five soil scientists are now in the U. S. for a 4-month period working at field locations to obtain on-the-job experience so they can become more proficient soil survey party leaders in carrying out reconnaissance surveys of high priority areas.

Hopefully, additional carefully selected Brazilian soil scientists with high potential will be able to obtain special training in the U.S. beginning in late 1968 and 1969. (See attachment for details). As a minimum, the Pedology and Soil Fertility Group should have a well

trained competent staff of 225 within 5 years. It now has 75. The recommended increase in personnel over a five year period will require adequate funding, both in amount and timeliness, in order to provide - continuity of operations.

4. In view of the high degree of technical competency of Brazilian soil scientists (although small in number) and the specific plans for training as outlined for fiscal years 1969 and 1970, it is my belief that a resident technical soils advisor from the U. S. will not be needed after December 1969. This presupposes, however, that a free interchange of ideas and information between soil scientists in Brazil and the U.S. will continue and that short-term consultants from the United States will be provided if needed.

5. Owing to the high degree of urgency for more detailed surveys, especially for areas already selected in Goiás and Mato Grosso, a concerted effort should continue to be made to obtain additional funds from the agencies most concerned such as I.B.R. Such surveys would be at the reconnaissance level. (See attached map that shows location of high priority areas).

6. A schematic soil map with accompanying interpretive maps for all of Brazil should be prepared. It is suggested that the level of generalization for the eastern one-third of Brazil be comparable to that of the map of the western two-thirds that was recently printed. This can be done by generalizing the more detailed soil surveys already made in this area and by exploratory studies for the remainder. Such a map can serve many agencies that are involved in the economic development of Brazil (See attached justification statement prepared by Dr. Aboilard).

7. The Pedology and Soil Fertility group should have responsibility for the development, maintenance and coordination of a nation-wide system of soil classification and correlation. Final decisions on classification and correlation of the named soil units for all soil surveys published by a governmental or quasi-governmental agency should rest with the Pedology group. It is particularly important that the research results obtained from experimental areas be correlated with

specific kinds of soil. This will make possible the extension of research results especially from studies in soil fertility, soil conservation and soil management to similar kinds of soil in other areas. At the same time more studies in soil fertility and soil conservation closely coordinated with soil surveys will enable more effective use of soil surveys.

# INTRODUCTION

This review and evaluation was made at the request of both the GOB and USAID/USDA in Brazil in response to the following airgram from Ambassador Tuthill in which assistance was requested on the following activities:

"1. Progress review and evaluation of the Resources Survey Project of the Frontier Homestead Program.

This will be the major activity Mr. Hockensmith will be involved in during his stay in Brazil. The Resources Survey Project had four major objectives when it was originally ennunciated in 1964. They were: (1) complete a schematic soil map of the project area to provide information on potential agricultural areas for settlement in the interior of Brazil; (2) publication of the soil and interpretive maps with supporting text including soil descriptions, interpretations and laboratory data; (3) make reconnaissance soil surveys of about 30,000,000 hectares of priority areas based upon the schematic soil map and other factors involved in settlement of frontier areas, and (4) increase the staff of the Division of Pedology and Soil Fertility by 60-100 field technicians to provide the nucleus of institutional capability to conduct a soil survey program for Brazil.

" Objectives 1 and 2 will be completed in calendar year 1968. It is proposed to reduce objective no. 3, reconnaissance soil surveys, to 12,500,000 hectares due to budgetary and personnel restrictions. The present work plans indicate a completion

date of August 1969 for the field work in Mato Grosso. Objective no. 4, dealing with an increase in technical staff, has resulted in 33 technicians added to date. No increase was effected in 19 7 or is anticipated in calendar 1968.

"This project has reached the point where it is necessary to decide upon the scope of future activities. The amount of available financing and staffing up to the present time and that postulated in the immediate future will not be sufficient to carry out the original objectives.

"2. Assist in discussions within the Division of Pedology and Soil Fertility concerning the organization of the technical and servicing arrangements to carry on an effective program throughout Brazil. Dr. Bloomfield, the Director of the DPFS, is in the process of reorganizing the Division of Soils.

"3. Funds for this position are provided for under PIO/T 80253."

On May 9, 1968, Mr. Hockensmith was directed by Lester R. Brown, Administrator of International Agricultural Development Service (IADS), USDA, with concurrence of D. A. Williams, Administrator of the Soil Conservation Service (SCS), USDA, "to review and evaluate the progress of the Resources Survey Project of the Frontier Homestead Program and to assist in discussions within the Division of Pedology and Soil Fertility (GOB) concerning the organization of the technical and servicing arrangements to carry on an effective program throughout Brazil," under USAID/USDA PASA, Brazil, LA(AJ) 29-65, authorization number 211-68, during the period May 26 to June 30, 1968.

## HISTORY OF PROJECT

In 1963 and earlier, considerable interest developed in Brazil to locate areas of soils in the interior of Brazil that would be suitable for new settlements. Several proposals were developed to determine the extent and location of relatively unsettled areas that could provide soil resources and economic opportunity for several million people from the northeast of Brazil and from other areas of excess population.

On May 30, 1964, a resources survey project agreement was signed between:

> The Coordinating Commission for the Alliance for Progress (COCAP), the Brazilian Ministry of Agriculture (the Ministry) and the United States Agency for International Development (USAID/Brazil), with the concurrence of the Brazilian Government Representative for Point IV (the Coordinator).

Some excerpts from this agreement are:

"I - CURRENT SITUATION

A. Large areas of Brazil known to have potential for development (under the right combination of crop, pasture, and forest use and with management adapted to the type of soil and terrain) are presently unoccupied. Settlement of these areas by low-income farmers from over-populated regions will contribute to Brazilian progress and stimulate economic and social development in an orderly manner, if this settlement can be guided by knowledge of the extent, location and qualities of arable soils and requirements for proper cropping and soil management.

"It is, therefore, particularly important to locate areas with soils that are suitable for cultivation by farmers who presently possess relatively little or no capital resources, education, and skills and to provide opportunities for these farmers to develop both skills and sound economic farm units.

"To meet the demand of the next 10 years it is estimated that 30 million hectares of soils of relatively high fertility will have to be located. To be used effectively in agriculture, these areas must also meet other conditions, including reasonable accessibility to markets and relative freedom from health hazards. After general economic feasibility for development has been determined, plans will need to be made for development on a significantly large scale to meet needs of families who desire to migrate and establish farms in the interior of Brazil.

"B. Priority attention is required for surveying areas in the states of Goiás, Pará, Mato Grosso, Amazonas, Maranhão, Piauí and Federal Territories of Amapá, Rio Branco and Rondônia to:

"1. Review climatic, geologic, vegetation, soils, transportation, population density, health and other available data bearing on suitability of the area for settlement. Cursory exploratory field studies, air photo interpretation and air observation will be the basis for developing the exploratory level soil survey of this large area. Exploratory level survey of 600 million hectares is planned to identify areas for further investigation and mapping.

"2. Survey at a reconnaissance level of selected areas thought to be suitable for settlement. This should result in classification and mapping of approximately 30 million hectares suitable for settlement under intensive land uses. Extensive field work as well as aerial observation and air photo interpretation will be required.

"3. Prepare maps with supporting descriptive material and make information available as rapidly as possible to serve the purpose of the agreement.

"4. Train specialists in soil survey procedures.

"C. Responsibility at the national level for the necessary soil surveys rests with the Division of Pedology and Soil Fertility (DPFS) within the Department of Research and Experimentation (DPEA) of the Ministry, the group most concerned with this project.

"II. PURPOSE

It is now proposed to perform a reconnaissance level soil and resource survey of frontier regions. Major emphasis will be on soils, climate, vegetative cover, surface water, and related factors which determine resource capacity for possible agricultural uses of the land.

"This information on resource capability, together with information on markets, health, demographic and social aspects, to be developed in complementary research, will serve as basis for developing policies and programs for frontier occupation and development.

"The survey is expected to indicate the areas in which it may be possible to carry on intensive cropping, those which are likely to be suitable only for well-managed forestry use, and those for which a combination of forestry, pasture and cropping is feasible.

"The survey has as a major aim the location of sufficient fertile soils having otherwise acceptable characteristics for relatively intensive cropping or crop and pasture combination to meet the settlement needs of Brazil of the next 10-12 years."

Later in 1964, IADS amended a USAID/USDA/Brazil PASA to furnish two soil scientists from the Soil Conservation Service, each for a two-year period. Accordingly, Dirk van der Voet served from January 29, 1965, to January 28, 1967, and Francis Cleveland served from February 1, 1965, to February 1, 1967, as soil scientist advisors to the Brazilians on this project. In fact, they were officed with the Brazilians in the Division of Pedology and Soil Fertility at the Jardin Botanica in the Ministry of Agriculture. On December 29, 1966, Lloyd E. Garland, a soil scientist in the SCS was assigned for a two-year period under the PASA to continue the technical advisory service previously conducted by Cleveland and van der Voet.

## CONDENSED WORK PLAN FOR PROJECT

A condensed plan of work for the Resources Survey Project follows:

I. Project Objectives

A. To locate 30,000,000 hectares of soil of relatively high fertility suitable for settlement within the interior of Brazil.

B. To increase the size, scope, and effectiveness of the soils staff within the Ministry of Agriculture.

II. Area of Operations

A. Western two-thirds of Brazil

1. The States of:

Acre - Amazonas - Goiás - Maranhão - Mato Grosso - Pará - Piauí.

2. The Federal Territories of:

Amapá - Roraima - Rondonia.

III. Size of Area

Square Kilometers: 6,000,000 equivalent to 600,000,000 hectares or 2,4000,000 square miles or 1,536,000,000 acres.

IV. Procedure of Operations

A. Phase I

Collection, review, evaluation and classification of available data on soils, geology, climate, vegetation, topography, population, transportation, markets, health (Publications, maps, research data).

B. Phase II

Schematic Soil Map of Project area, with accompanying legend and interpretive soil maps under three levels of management.

1. Purpose:

To indicate those areas which are:

a. Suitable for settlement.

b. Not suitable for settlement.

(Too steep or rough, too wet, or infertile.)

c. Questionable, requiring further study.

2. Based on:

a. Previous soil studies and experience.

b. Exploratory field studies.

c. Information on geology, climate, vegetation and topography.

d. Aerial photo interpretation.

e. Air observation.

f. On-the-ground field examinations of areas delineated by phto interpretation.

C. Phase III

Reconnaissance soil survey of 30,000,000 hectares.

1. Purpose:

To confirm and more accurately identify those areas that appear suitable for settlement which will permit efficient use of land on a sustained basis.

D. Interpretations of Soil Map Units included in report accompanying maps.

1. Suitability of soil areas for development is indicated under three kinds of management:

a. Traditional farming methods.

(Hoe, machete, no fertilizers)

b. Semimodern farming methods.

c. Modern farming methods.

(Machinery, fertilizers, skilled operators)

2. Soil areas are rated:

   a. Good.

   b. Fair.

   c. Poor.

3. Factors limiting soils areas for agricultural use are:

   a. Low natural fertility.

   b. Excess water.

   c. Inadequate water.

   d. Limitations for use of modern machinery.

   e. Susceptibility to erosion.

   Limitations are rated as slight, moderate, severe.

E. Coordination Required in Selection of Areas for Reconnaissance Survey.

Other agencies of the Brazilian Government also having responsibilities for settlement and development of the interior.

1. INDA - National Institute for Agricultural Development.
2. IBRA - Brazilian Institute for Agrarian Reform.
3. CIVAT- Interstate Commission of the Araguaia and Tocantins Valleys.
4. Other Agencies.

F. Training.

1. Provide in-service-training to 75-100 Brazilian scientists and technicians in soil survey techniques and procedures to include:

   a. Field and laboratory methods for soil and land classification.

   b. Cartography.

   c. Air photo interpretation.

d. Preparation of text to accompany maps.

e. Interpretation and use of resource surveys in planning.

2. Key men to have training in the United States.

3. Student trainee programs during university vacations.

V. Technical assistance under PASA

A. Two soil scientists, 1965 and 1966, and one soil scientist, 1967 and 1968, USDA-SCS.

1. Soil Survey Interpretations

2. Soil Survey Operations and Air Photo Interpretations.

B. Short-term consultants.

These are specialists in various areas of soils for one to three months duration: Guy D. Smith, A.C.Orvedal, and Roy D. Hockensmith.

Translated from Portuguese

April 1968

Technical Agricultural Office
Natural Resources Survey Program
MA/CONTAP/USAID/ETA Agreement
Project II - Soil Survey

# 1968 WORK PLAN

## I - CURRENT SITUATION ANALYSIS

1.1 The lack of knowledge about the characteristics of the soils of Brazil has been a limitating factor in the national agricultural development. Since the initiation of the project activities in 1965, a large amount of data has been compiled through soils explorations which makes it possible to locate areas with potential for development in terms of food production.

1.2 The project covers a broad field of research, in the use of land, which will facilitate the existing program of the Equipe de Pedologia e Fertilidade do Solo (EPFS), of the Escritório de Pesquisa e Experimentação (EPE), Ministry of Agriculture, of developing a soil map of Brazil.

## II - PURPOSES

2.1 The objectives of this project remain the same as enunciated in the original agreement, that is, to locate soils suitable for intensive cultivation of crops and pastures, to satisfy the demand of colonization in the next 10 years.

2.2 In this study of the resources, according to the original agreement, special attention will be given to soils, climate, vegetation, surface water and other aspects, which can determine the land resources and their use in agriculture.

2.3 An intensive training program will be provided for new soil scientists to help reduce the delay in utilizing their services in the activities of the EPFS.

2.4 In view of the original objectives, this work plan indicates the application of the resources from the Ministry of

Agriculture and CONTAP to finance the activities in 1968 for reaching the following goals:

A. Conclusion of the 1st. Approximation of the Schematic Soil Map

1. Two thousand additional copies of the schematic soil map will be printed. The copies already printed will be used to put in the publication and the rest will be distributed on a selective basis.
2. Five thousand copies of the report, to accompany the schematic soil map and interpretive maps, will be printed.
3. The target date for submitting the manuscript to the printers was May 1968. The projected date for release of the publication (maps and reports) is August 1968, subject to delays in the printing process.

B. Give Continuity to Reconnaissance Soil Surveys in the MT-1 and MT-3 areas in the south of Mato Grosso, with cooperation from IBRA and other institutions. A detailed work plan for the MT-1 area in Mato Grosso and the GO-1 area in Goiás was prepared in 1967. The substitution of the MT-3 area for GO-1 area will provide the specific details needed for continuity of the work.
The main points are:

1. Classification and Mapping:

   a. To complete the soil survey in the MT-1 area, about 72,000 $km^2$, during 1968.
   b. To prepare the preliminary legend for the MT-3 area and a small part of MT-2 area while the survey progresses in the MT-1 area so that the field party can move to the MT-2 and MT-3 areas in the beginning of 1969 without undue delay.

c. To prepare the descriptive legend of the areas surveyed, basically the 1st. approximation of the survey report, at the same time the soil surveys are done.

2. Interpretations:

a. To collect information from selected farms in the survey areas about yields of major crops, carrying capacity of pastures, management practices, etc., and relate them to soil classification units, whenever possible. Collect at the same time for the same farms information referring to land use, farm organization, micro-climate, etc.
Prepare mimeographed forms for recording the above information and send them to the party chiefs for implementation.

b. To collect basic data about crop yields and management practices, by soil classes if possible, from field experiments and research in the survey area and adjacent areas in the states of Goiás, Mato Grosso, Minas Gerais, Paraná and S. Paulo. The information obtained will then be analysed and extrapolated to similar soils in the reconnaissance survey areas.

c. To collect information of the macro-climate data available at the meteorologic stations in and adjacent to the reconnaissance survey areas (states of Goiás, Mato Grosso, Minas Gerais, Paraná and S. Paulo and the country of Paraguay).

d. To appoint a soil correlator (interpretations) for EPFS in 1968 who will be responsible for the coordination and supervision of the interpretive work.

3. Investigations:

Collect samples and analyse the representative soils

of the survey areas as the survey progresses for characterization and engineering properties plus fertility determinations of the surface horizons.
To promote the assistance of DNER and other institutions for analysing the soils for engineering use if they are interested.

C. Exploratory Soil Trips:

1. The number of exploratory trips to areas where soils information is lacking will depend upon the availability of financial resources, provided by CONTAP for 1968 and on priority needs of other activities of the soil survey. These trips were indicated in the work plan for 1967, but were halted for lack of funds.

D. Reconnaissance Soil Surveys of other priority areas inside the project area:

1. If additional funds and technicians had been available early in 1968, it would have been possible to initiate surveys in other priority areas. Without the funds for recruitment of new technicians it was not considered feasible to start more surveys. Financial resources alone, available later in 1968, will not be sufficient to warrant starting surveys of other priority areas.

E. Recruitment and training of new technicians to increase the EPFS staff.

1. This objective was abandoned in 1967 and part of 1968 because of lack of funds. A new plan will be developed in September 1968 to train 40 new soil scientists during a two months formal training session scheduled for January and February 1969. The trainees selected by EPFS will receive intensive in-service training for 16 months. This plan of recruitment and training for 1968-69 will depend upon formal commitments from CONTAP to provide funds to carry out the

two months formal training and from the Ministry of Agriculture to provide funds for salaries and operatin expenses for the 16 months.intensive field training. When the complete training period is over, the EPFS will select 10 technicians to work in Soil Classification and Surveys, 2 for Soil Chemistry, 2 for Soil Fertility, 2 for Soil Physics, 2 for Conservation and Management of Soil, 2 for Interpretations, and 2 for Soil Mineralogy.

F. Training Program in the United States: (by chronological date of departure) depending upon availability of funds:

12 to 10

1. Five scientists for party chief training during a period of 4 months, starting March 1968.
2. One scientist for applied training in soil mineralogy during a period of three months, starting December 1968.
3. Three scientists for party chief training during a period of 4 months each, starting December 1968.
4. One scientist for training in the responsibilities and obligations of supervising soil survey operations on a national level and coordinating the operations at county and state levels. Length of training: 4 months, starting December 1968.
5. One scientist for training in the responsibilities and obligations of supervising the soil survey interpretations at a national level, and coordinating the interpretations at county and state levels. Length of training: 4 months, starting December 1968.
6. One scientist for training in soil fertility, to supervise the operations on a national level, and coordinating the activities at county and state levels. Length of training: 4 months, starting December 1968.

G. Insure continuity of the activities of the Project with IPEAN, the regional laboratory of EPE in Belém, Pará.

1. Insure continuity of the cooperation and financial agreement of 1967 for technicians of IPEAN who worked for the project in the field and laboratory. The financial agreement will end in December 1968, and the activities will continue with resources from the Ministry of Agriculture.

H. Integration of personnel and activities of the Project into regular operations and budget of EPFS and IPEAN.

1. It is the intention of EPFS, within its responsibiliti to implement the process of integration during 1968 through requests of sufficient resources from the Ministry of Agriculture to integrate the personnel of the project who have been maintained with extra resources up to now.

## III. EXECUTOR OFFICE AND LOCATION

3.1 The entity directly responsible for the execution of this Project is the EPFS from the Escritório de Pesquisa e Experimentação (EPE), Ministry of Agriculture.

3.2 The Executor of the Project, indicated by the Director of EPE and appointed by the General Coordinator, in the development of the activities will be bound by the clauses of the MA/CONTAP/USAID/ETA agreement signed in 1.16.1968.

3.3 The following priority areas were selected for operations, States of Piauí, Maranhão, Pará, Amazonas, Acre, Mato Grosso, Goiás and the Territories of Roraima, Rondônia and Amapá.

3.4 The application of resources will be in accordance with the needs for development of activities.

## IV. CURRENT SITUATION AND PROJECTION

4.1 As already mentioned, this Project is in continuation to the work started in 1965, as a result of an agreement signed between the Ministry of Agriculture and USAID/Brazil in

4.30.64. We can mention the following results obtained to date:

a. Intensive training of 39 new technicians for soil surveys of which 33 were added to the roster of the EPFS.
b. Planning, completion, and printing of the schematic soil map and interpretive maps.
c. Writing of final report.

V. MEANS OF ACTION

The planning and completion of the work necessary for soil survey and mapping of the broad area of the Project will be carried out in accordance with the resources of EPFS, as follows:

a. Utilization of the present team of technicians, in field operations, through exploratory trips to selected areas.
b. Collection of data to prepare reports, maps, etc.
c. Recruitment and training of new technicians.
d. Use of laboratory for sample analysis.
e. Utilization of EPFS facilities for the execution of the operations.

VI. DURATION

This Project will remain in effect until December 31, 1968, and can be extended by common agreement of all parties.

VII. FINANCIAL APPLICATION

It is provided to this project the initial amount of NCr$ ..... 200,000.00 (two hundred thousand new cruzeiros) to be applied as follows:

| | |
|---|---|
| 1 - Personnel ..... | 85,000.00 |
| 2 - Travel, Per Diem, and Transportation .. | 30,000.00 |
| 3 - Consumable Material and Supplies ..... | 15,000.00 |
| 4 - Permanent Material ..... | 15,000.00 |
| 5 - Miscellaneous (printing) ..... | 35,000.00 |
| 6 - Technical Reserve ..... | 10,000.00 |
| General Coordination ..... | 10,000.00 |
| | 200,000.00 |

III. PROFIT

The eventual income resulting from the execution of this Project shall be deposited in a special account at the Banco do Brasil, S. A. and might be applied in the development of the Project, after presentation of a Work Plan and Financial Application to be approved by the General Coordination.

Rio de Janeiro, 17 of May, 1968

signed

Nathaniel Jose Torres Bloomfield
Executor

signed

Hernani Santiago Tribusi
Coordination Assistant

Approved by ETA Deliberative Board - JD-365 , of 17/5/1968

## ACCOMPLISHMENTS TO DATE

Considering the problems and obstacles encountered, reasonable progress has been made in the first three years of Project operations. Specific accomplishments are as follows:

I. Exploratory soil survey

A. Schematic soil map and three interpretive soil maps of the western two-thirds of Brazil are completed and were printed in February 1968.

B. Text and tables to accompany the soil maps are to be sent to printer in August 1968.

II. Reconnaissance soil surveys in southern Mato Grosso and Goias

A. Three (3) field soil survey parties of up to five men each are in the MT-1 area in southern Mato Grosso where they expect to complete the field mapping of 72,000 $Km^2$ (17,770,000 acres), December 31, 1968. In early 1969, the parties will then move to the MT-3 area comprising 53,000 $Km^2$ (13,000,000 acres).

B. Samples of soil for (1) fertility studies, (2) soil characterization, and (3) engineering tests are being collected concurrently with field soil surveys.

C. The operation in the MT-1 area of southern Mato Grosso also includes the collection of some yield and management information from selected farms in the survey area. The information to be collected by the field parties in the course of the survey will involve the major crops related to the important soils of the area. This program will be supplemented by the initiation of a

compilation of available crop, climatic, and management data, by kinds of soils, from field experiments and trials in adjacent states. These results will be extrapolated to similar soils in the area of reconnaissance surveys.

E. A preliminary report of the soil potential of the Iguatemi area (approx. 3300 km2) in the southern tip of the MT-1 area was completed and submitted to IBRA (Brazilian Institute for Agrarian Reform) in January, 1968. This report provides IBRA with information on the agricultural potential of the area for use in their colonization activities. Field sheets at a scale of 1:60,000 were also included.

F. An agreement between the Ministry of Agriculture and the Brazilian Institute for Agrarian Reform (IBRA) that was signed in August 1967 has made it possible to continue the reconnaissance surveys of 125,000 $Km^2$(31,250,000 acres) in the MT-1 and MT-3 areas in southern Mato Grosso through August 1969.

III. Training

A. Annual Basic Soil Survey Course -

1. Jan. 10-March 15, 1966.
2. Forty-two recent graduates of Brazil's Agricultural Colleges.
3. USDA-SCS soil scientists assisted in instruction.

B. In-Service Training in the following subjects is continuing:

1. Soil survey interpretations.
2. Aerial photo interpretations.
3. Soil survey operations.

C. Training in U.S.

1. Five Brazilian soil scientists with high potential are in U.S. from March 28, 1968, to July 27, 1968, for intensive training in soil survey operations so they can become more competent soil survey party leaders when they return to Brazil. They are Humberto Gonçalves dos Santos, Raphael David dos Santos, Antonio Ramalho Filho, Jeronimo Cunha Almeida, Antonio Manoel Pires Filho.

D. Owing to inadequate funds, there was no recrutting and training during January and February 1968 as was scheduled.

IV. Uses of Maps and Associated Data by:

A. IBRA - Soil survey field sheets and an iterim special soil report covering 3500 $Km^2$ of this area were submitted to IBRA for use in colonization.

B. INDA

C. DNER

## Future Work

Brazil has vast soil resources. Development of these soil resources is essential to keep pace with increases in population and to assure the people an adequate standard of living.

The results from this project can aid greatly in the economic development of Brazil and the social welfare of its people. The soil maps can aid in locating new areas for settlement. They are helpful especially in showing areas where settlers can have a reasonable chance of success as far as soil potentialities are concerned. Once the suitable areas are located, roads and other facilities can then be more wisely planned and constructed to aid in the development of these areas. These soil surveys can also help people select and manage soil areas best suited to produce adapted crops efficiently on a sustained basis and thus help increase foreign exchange earnings and promote economic growth.

Reconnaissace soil surveys of the high priority areas will require an increase in funds and more trained soil scientists. Completion of a schematic soil map for <u>all</u> of Brazil should be helpful to National planners and many others.

(See Garland's annual report for specific jobs that should be carried forward).

Justification for Exploratory Soil Survey for the Northeastern, East and South Regions of Brazil **(written by Dr. Abeilard).**

When the agreement Ministry of Agriculture x USAID for soil surveys in the States of Piauí, Maranhão, Pará, Amazonas, Acre, Mato Grosso and Goiás, and also in the Territories of Amapá, Rondônia and Roraima was signed, the main objective was to locate areas with soils suitable for cultivation.

The increase of Brazilian population required a study of areas feasible for settling the population from other States with an excess of hand-labor. The assimilation of hand-labor could not be done only in industry. The need of specialization or semi-specialization is one of the requirements for hand-labor in industry. Therefore, agriculture is the solution for unemployment.

To establish new areas suitable for agriculture, in a low technological level, it was necessary to make an inventory of the soils in unknown areas of the country. After identification of areas with greater potential, more detailed studies are now being made in those areas.

After completion of the first phase of the agreement, the exploratory soil surveys, a map was made showing the soil distribution in the region. General information about the mapped soils will be included in a bulletim to be released this year.

The examination of the maps and the information obtained with the explorato soil survey has raised inumerous questions about the reasons why the Brazilian States located in the Northeaster, East and South, have not been surveyed, in order to give together with the recent finished map a general and complete idea of the Brazilian soils.

This question is hard to answer. In those States, where general work conditions are easier, soil surveys have been done in more detail, , and by that reason slower to complete. To judge the results of this type of survey (reconnaissance) it should be known that from 1952 up to now, the following areas have been surveyed: State of Rio de Janeiro (including the former Distrito Federal), São Paulo, and other scattared areas as: North par of Rio Grande do Sul, Pernambuco (Zona da Mata), Furnas, Jequitinhonha valley.

Without any doubt, the reconnaissance soil surveys provide more precise

information than the one obtained in exploratory soil surveys, as more detailed surveys, at series level, will provide more accurate information.

In the present stage of development, it seems that the best solution for th inventory of Brazilian soils, would be the establishment of a priority in relation to the level of soil surveys. First of all, the exploratory survey of Brazil would be finished.

The reconnaissance soil surveys would be carried out in areas suitable for agriculture, colonization and settlement of hand-labor moved from other regions. Finally, the detailed surveys, at soil series level, would be carried out in farms and agricultural research stations, and also studies of the feasibility of irrigation programs and drainage of the areas.

The phases mentioned above would correspond to progressive steps of work and done in priority order.

The first step includes the exploratory surveys of Brazilian soils and general information about them.

In the present stage where the exploratory survey of 6 millions of $Km^2$ (600 millions of hectares) has been completed, it is fully justified the continuity of surveys in the other 2.5 millions of $Km^2$ of the national territory, not only to complete the map; but for the following reasons:

1. The agencies responsible for the planning of Brazilian economy would have basic elements to evaluate the feasibility of investment for agriculture.

2. The development of areas occupied by the most important Brazilian cultures (coffee, cocoa, sugar cane, rubber and corn, etc.) could be planned in advance, according to the knowledge of soils. This aspect is particularly important in the cultivation of cultures for export, which yields will depend on proper location, and consequently , the price offered on international market.

3. Develop a program to move cultures from less suitable soils to soils with better suitability to obtain higher yields.

4. Develop a program of Public Services as construction of dams, electrization, transportation, storage and silo, based on informations about soils that will provide the oportunity to evaluate the needs of the various regions for these resources.

Beside the reasons above, the following can be included, mentioned by J. Bennema (Soil Resources, Inauguration Class at Delft, Netherlands, 1968) to justify the need for soil surveys:

1. To locate better soils for agricultural use, under primitive management. These soils correspond to the soils with high fertility, good drainage and enough moisture.
2. The great areas of Latosols in the tropics constitute the greater soil potential for agricultural use in the future, as long as high investment of capital and know-how are applied to improve these soils for agriculture.
3. In Brazil, the soil surveys have to contribute also for the development of the areas near the coast, where agriculture is already established and efforts are being made for modernization.

By the discussion above, it seems justified the need for completion of the exploratory soil survey of Brazil, in short-term, so that with the information available the Brazilian government may equate the problems of the country.

## Notes on Review of Field Work in Mato Grosso, June 3-7, 1968

This is one of the high priority areas selected by the M.A. on the basis of information from the exploratory survey. A reconnaissance soil survey to help locate more precisely (than shown on the schematic soil map) the soils that are suitable for settlement was begun in October 1967 with financial assistance from IBRA. The field work in this survey area (MT-1, MT-3) of 125,000 $Km^2$ is scheduled for completion by September 1969 with published maps and text released by September 1970. The survey area is located about 600 miles by air and 900 miles by road from Rio.

I accompanied Dr. Nathaniel José Torres Bloomfield, Director of Pedology and Soil Fertility; Dr. Abeilard Fernando de Castro, in charge of Soil Survey Operations and Soil Fertility, both in M.A.; and Lloyd E. Garland, USAID/USDA by airplane to Campo Grande, Mato Grosso where we joined Dr. Flávio Garcia de Freitas who is in charge of the three soil survey field parties in the MT-1 and MT-3 areas of Mato Grosso.

During the next four days the five of us drove 600 miles, examined soils, inspected soil survey field sheets, and held conferences with the field parties consisting of:

Estevão Machado Moura
Idarê Azevedo Gomes
José Silva Rosatelli
Reinaldo Oscar Potter
João Gralha Tomasi
Klaus Peter Mittern
Elias Pedro Mothci
Luiz Alberto Regueira Medeiros
João Alberto Martins do Amaral
Manoel Faustino Neto
Francesco Palmieri
João Luiz Rodrigues de Souza
Helio da Costa Almeida

Those not present in Brazil because they are in the U. S. for additional training are:

Humberto Gonçalves dos Santos
Antonio Ramalho Filho
Raphael David dos Santos
Antonio Manoel Pires Filho

Although there is only a small percent of the area presently used for cultivated crops, the correlation between crops yields and kind of soil is clearly evident. Unfortunately some existing farms comprise only poor soils where the settlers have little chance to succeed. But the settlers located on good soils are getting relatively high yields even under primitive methods of farming.

Members of the survey parties are attempting to get yield data for each of the major highly contrasting kinds of soil so that these data can be extended to other areas with similar kinds of soil and used to guide future settlements. (See attachment for form used in collecting yield data). The soil scientists, however, are having difficulty in getting farmers to reveal their crop yields. Nevertheless, the soil scientists are pursuing their efforts although sometimes indirectly through extension agents and other means. The problem is that farmers are suspicious of strangers who ask for such data partly because of the possibility that such data may affect their taxes.

The field sheets we examined were neat and legible. Tentative descriptions of the soil taxonomic units were prepared mostly prior to mapping. The soil mapping units are revised during the course of mapping. Final descriptions will not be prepared until after the laboratory data are completed. (Attached is an example of a soil mapping unit description, profile descriptions and characterization data, and fertility data for Dark Red Latosol, Dystrophic, loamy texture, semi-evergreen forest (L-1).

Mapping of this 125,000 $Km^2$ area in Mato Grosso is at a scale of 1:60,000 but publication is expected to be a scale of 1:500,000. It is expected that 50,000 $Km^2$ will be completed by July 1968. About 450 soil samples have been collected for fertility tests, and 15 soil profile samples have been collected for soil characterization. About

25 more profiles will be sampled for characterization data. Samples for engineering tests will also be collected for many of the major soils.

A standard nation-wide form is being developed for use in collecting crop yield data by kinds of soil. Summary forms are also being standardized for reporting chemical and physical data on soils.

Although the precipitation in this area is 1200 to 1500 mm, there is a dry period usually from May 1 to October 15 in the northern and northwestern part. See attached table for climatic data at Campo Grande, Mato Grosso. It should be pointed out, however, that the relative humidity is around 70% during the dry season. The dry period in the southeastern part is much shorter. In fact, in some years there is no distinct dry period. The mean temperature in winter is 68ºF and in summer is 80ºF.

Fertility tests indicate that all the soils in this area respond to Zn, as well as to N, P, K and to Ca and Mg.

The principal crops that are grown in this area are: corn, rice, beans, cotton, peanuts, castor bean, mandioca, sugar cane, and coffee. Soybeans, sorghum and sunflowers are being introduced.

A Federal Experiment Station of the M.A. located about 10 km southwest of Campo Grande is engaged in testing new crops, cultural practices and grazing management. Several 125 hectares plots are now in operation in grazing tests using Jaraguá grass. This is under the local direction of Dr. Renato Garcia Leoni who is highly capable man.

## IDENTIFICATION LEGEND OF MT-1 - Mato Grosso

| | |
|---|---|
| Red-Yellow Podzolic Equivalent eutrophic, medium texture, semi-evergreen forest | PA Eu |
| Dark Red Latosol dystrophic, heavy texture, semi-evergreen forest | LE 1 |
| Dark Red Latosol dystrophic, heavy texture, cerrado | LE 2 |
| " " " " " grassland | LE 3 |
| Dark Red Latosol dystrophic, medium texture, semi-evergreen forest | LE 4 |
| Dark Red Latosol dystrophic, medium texture, cerradão | LE 5 |
| Dusky Red Latosol eutrophic, heavy texture, semi-deciduous forest | LE Eu 1 |
| " " " " " semi-evergreen forest | LR Eu 2 |
| Dusky Red Latosol dystrophic " " " " | LR Di 1 |
| " " " " " cerrado | LR Di 2 |
| " " " " " Grassland | LR Di 3 |
| Red-Yellow Latosol dystrophic, heavy texture, cerrado | LV |
| Apa unit (probably Red-Yellow Podzolic soil, cobbly, medium texture, cerrado and grassland) | APA |
| Red and Yellow Quartz Sands dystrophic, semi-deciduous forest | AV 1 |
| Red and Yellow Quartz Sands dystrophic, semi-evergreen forest | AV 2 |
| Red and Yellow Quartz Sands dystrophic, cerrado | AV 3 |
| " " " " grassland | AV 4 |
| Lithosolic Soils eutrophic, underlying by basalt, deciduous forest | Li |
| Organic soils dystrophic, phase ... | O Di |
| Gley Humic Soils dystrophic, phase ... | GH Di |
| Low Humic Gley Soils dystrophic, phase ... | GP Di |
| Humic Hydromorphic Sands dystrophic, phase ... | AH Di |
| Ground-Water Podzol, phase ... | PHi |
| Alluvial Soils eutrophic, phase ... | Al Eu |
| " " dystrophic, phase ... | Al Di |

xxxxxxxxxxxxx

Tentatively distinction of alic (álicas) and non-allic (não álicas) transitions of the same soil classes, if they exist and can be mapped.

Separation of relief phases: Level, gently undulating, rolling, hilly and mountainous. In addition, whenever possible, separation of slope classes: 0-3%, 3-8%, 8-20%, 20-40%, 40-70%. When not feasible, evaluate the percentage of these classes of slope by phases of relief.

## IV - LEGENDA DE IDENTIFICAÇÃO

### SOLOS COM B TEXTURAL

PA Podzólico Vermelho Amarelo Equivalente Eutrófico textura média fase floresta semi-sempre-verde de primeira classe.

### SOLOS COM B LATOSSÓLICO

L1 Latosol Vermelho Escuro Distrófico textura média fase floresta semi-sempre-verde de primeira classe.

L2 Latosol Vermelho Escuro Distrófico textura média fase floresta semi-sempre-verde de segunda classe.

L3 Latosol Vermelho Escuro Distrófico textura média fase transição floresta-cerrado.

### SOLOS POUCO DESENVOLVIDOS

AV1 Areias Quartzosas Vermelhas e Amarelas Distróficas fase cerrado.

AV2 Areias Quartzosas Vermelhas e Amarelas Distróficas fase campestre.

AV3 Areias Quartzosas Vermelhas e Amarelas Distróficas fase campo de várzea.

AI Solos Aluviais.

### SOLOS HIDROMÓRFICOS

HI Grupamento Indiscriminado de Solos Orgânicos Distróficos, Solos Glei Húmico Distróficos e Solos Glei Pouco Húmico Distróficos.

### ASSOCIAÇÃO

AV2-HI Areias Quartzosas Vermelhas e Amarelas Distróficas fase campestre associadas com Grupamento Indiscriminado de Solos Orgânicos Distróficos, Solos Glei Húmico Distróficos e Solos Glei Pouco Húmico Distróficos.

LATOSOL VERMELHO ESCURO DISTRÓFICO textura média fase floresta semi-sempre-verde do primeira classe. (L1)

Esta unidade do mapeamento ocupa, também, grande extensão geográfica na zona, sua área correspondo aproximadamente a 20,5 % do total. Está pràticamente localizada na porção norte o nordeste ocupando, via de regra, espigões aplainados do relêvo geral.

Estão incluidas nesta unidade do mapeamento pequenas áreas do Latosol Vermelho Escuro Distrófico textura média fase floresta semi-sempre-verde do segunda classe o Grupamento Indiscriminado de Solos Hidromórficos Distróficos.

Como principais variações nesta unidade temos:

a- Solos de textura da classe pesada/o

b- Solos intermediários para a unidade Podzólico Vermelho Amarelo Equivalente Eutrófico textura média fase floresta semi-sempre-verde.

O relêvo desta unidade varia de pràticamente plano a suave ondulado, com declives que variam de 1 a 3%, predominando a última classe do relêvo. Os vales se apresentam em "V" aberto com vertentes de dezenas de metros, são pequenos, correspondendo às cabeceiras de dranagem, em virtude desta unidade ocupar principalmente os espigões do relêvo geral. Ocorrem áreas de maior declividade próximo ao rio Paraná. Os solos desta unidade ocupam, também, em pequenas áreas, o terço superior das vertentes mais suaves do vales dissimétricos ou monoclinais.

A vegetação característica desta unidade é a floresta semi-sempre-verde do primeira classe, apresentando-se sob a forma de mata cujos representantes do estrato superior alcançam 20 a 25 m de altura. Ali encontram-se com freqüência a peroba (Aspidosperma sp.), o cedro (Cedrela fissilis), o ipê (Tecoma sp.) e o palmito (Euterpe edulis). Cumpre assinalar que o porte desse vegetação, se bem que de primeira classe, não é tão notável quanto a vegetação dos solos da unidade Podzólico Vermelho Amarelo Equivalente Eutrófico textura média fase floresta semi-sempre-verde do primeira classe.

O material originário sôbre o qual se desenvolveram os solos da presente unidade é, também, pseudo autóctone e resultante da decomposição do Arenito Caiuá do Jurássico.

Esta unidade é relativamente utilizada na agricultura. Como culturas principais temos: café, milho e arroz. Algumas pastagens de capim colonião são encontradas.

Esta unidade de mapeamento constitui-se de solos minerais, de textura média, muito profundos, acentuadamente drenados, muito porosos, de coloração vermelho escuro, ácidos, com capacidade de permuta de cations (T) e percentagem de saturação de bases (V) baixas, relação textural B/A variando de 1,4 a 1,7, relação $Al_2O_3$ / $Fe_2O_3$ no horizonte B entre 2,65-3,10.

São correlacionados à unidade Latosol Vermelho Escuro fase arenosa, descrita no Levantamento de Reconhecimento dos Solos do Estado de São Paulo.

São solos com B latossólico, de textura média, com médio teor de ferro e relação $Al_2O_3 > 1,57$ e $< 3,14$.

São classificados como Latosol Vermelho Escuro Distrófico textura média, em nível de categoria de Grande Grupo.

Estes solos apresentam perfil do tipo A, B e C com espessura superior a 200 cm, com fraca diferenciação de horizontes. Os solos aqui considerados exibem como características notáveis: grande profundidade, coloração bruno avermelhado escuro na parte superficial e vermelho escuro no horizonte B; textura no horizonte A da classe franco arenoso e franco arenoso a franco argilo arenoso no horizonte B; estrutura do tipo maciça porosa pouco coerente "in situ" com alguns elementos fracos de tamanho pequeno a médio de forma granular no horizonte A e maciça porosa pouco coerente "in situ" no horizonte B; transição plana e difusa entre os horizontes A e B.

São acentuadamente drenados, bastante permeáveis, muito porosos e de consistência muito friável. Há total floculação dos colóides no horizonte B. São susceptíveis à erosão quando em parcelas de declividade mais acentuada do que o normal.

Quanto às propriedades químicas, apresentam reação ácida em todo o perfil com pH em tôrno de 5. A soma das bases permutáveis (S) apresenta valôres mais elevados no horizonte superficial, decrescendo com a profundidade do perfil. Ca e Mg, destacam-se como principais bases trocáveis. A saturação de bases é média a alta no horizonte superficial, variando de 42 a 49 %. No horizonte B ela decresce com a profundidade, sendo baixa, ou seja, inferior a 35%.

A relação molecular $SiO_2$ / $Al_2O_3$ (Ki) é baixa, em tôrno de 2,0, evidenciando solos intensamente meteorizados. A relação molecular $SiO_2$ / $Al_2O_3$ + $Fe_2O_3$ (Kr) é também baixa, da ordem de 1,5. Apresenta problema de $Al^{+++}$ trocável.

Na composição mineralógica o constituinte dominante é o quartzo. Quase não apresentam reservas de minerais primários. A fração argila tem como componente dominante a caulinita. São de fertilidade natural média a baixa. Seu uso agrícola é limitado pela fertilidade e relêvo, necessitando por isto de práticas de calagem e adubação química. A conservação do solo deve ser usada nas partes de relêvo mais movimentados.

Êstes solos são atualmente cultivados com café, milho, arroz, amendoim, mandioca e pastagem de capim colonião, embora grande parte da área dos mesmos ainda estoja ocupada por reservas florestais.

Permitem boas safras sòmente durante os primeiros anos de cultivo, pelo fato de apresentarem fertilidade natural média.

Alguns problemas quanto a erosão podem ocorrer, podendo ser sanados pela adoção de práticas simples de melhoramento, pois o relêvo dominante é plano a suavemnet ondulado, que condiciona também uma mecanização livre de impedimentos.

A limitação por deficiência de água nestes solos é ligeira, influindo apenas durante um certo período da estação de crescimento da maioria das culturas.

Portanto, dadas as boas propriedades físicas destes solos, há grandes possibilidades de melhoramento, se for adotado um sistema de agricultura desenvolvida.

PERFIL - GT-SOL n 4

DATA - 10/12/67

UNIDADE - Latosol Vermelho Escuro Distrófico textura média fase floresta semi-sempre-verde do primeira classe

LOCALIZAÇÃO - A 14 Km de Iguatemi, na estrada Iguatemi-Cel. Renato, a 30m do lado esquerdo da estrada.

SITUAÇÃO E DECLIVE - Perfil descrito e coletado em trincheira aberta em relevo praticamente plano com declives até 3% e com cobertura vegetal de floresta tropical semi-sempre-verde.

ALTITUDE - 300 m

LITOLOGIA E FORMAÇÃO GEOLÓGICA - Arenito - Jurássico

MATERIAL ORIGINÁRIO - Arenito Caiuá

RELÊVO - Praticamente plano, com declives variando de 1 a 3%

EROSÃO - Praticamente ausente

DRENAGEM - Acentuadamente drenado

VEGETAÇÃO - Floresta tropical semi-sempre-verde com ocorrência de palmito.

USO ATUAL - Reserva Florestal.

$A_0$ - 6 - 0 cm, horizonte constituido por detritos vegetais em adiantado estado de decomposição.

$A_1$ - 0 - 10 cm, bruno avermelhado escuro (2.5 YR 3/4, úmido) e bruno avermelhado escuro (2.5 YR 3/4, úmido amassado); franco arenoso; maciça porosa não coerente "in situ" composta / por grãos de areia e poucos elementos de estrutura fraca pequena a média granular; ligeiramente plástico e ligeiramente pegajoso; transição plana e clara.

$A_3$ - 10 - 37 cm, bruno avermelhado escuro (2.5 YR 3/3, úmido, e bruno avermelhado escuro (2.5 YR 3/4, úmido amassado); franco arenoso; maciça porosa não coerente "in situ" constituida por grãos de areia e poucos elementos de estrutura / fraca pequena a média granular; ligeiramente plástico e ligeiramente pegajoso; transição plana e gradual.

$B_1$ - 37 - 105 cm, vermelho muito escuro (10 R 3/4); franco argilo arenoso leve; maciça porosa pouco coerente "in situ"; ligeiramente plástico e ligeiramente pegajoso; transição plana e difusa.

$B_{21}$ - 105 - 160 cm, vermelho muito escuro (10 R 3/5); franco argilo arenoso; maciça porosa pouco coerente "in situ"; plastico e pegajoso; transição plana e difusa.

$B_{22}$ - 160 - 300 cm +, vermelho escuro (2.5 YR 3/6); franco argilo arenoso; maciça porosa pouco coerente "in situ"; plastico e pegajoso.

OBSERVAÇÕES - Coletada amostra de fertilidade nº F 50 GT-SOL.
Trincheira de 190 cm de profundidade, a partir daí foi usado o trado de caneco.
Raizes pivotantes primárias e secundárias, com diâmetro variando de 1mm a 5cm, predominando as de diâmetro entre 1 e 3 mm, assim distribuidas: abundantes nos horizontes $A_1$ e $A_3$ comuns nos horizontes $B_1$ e $B_{21}$ e raras no $B_{22}$
Perfil descrito e coletado em dia nublado com ocorrência de chuvas e pancas, razão pela qual não foi possivel proceder-se a determinação de pH no campo, bem como as cores em amostras secas e secas trituradas.
Não foi coletada amostra do $A_0$.

## ANÁLISE MINERALÓGICA

MT-SOL 4 - LATOSOL VERMELHO ESCURO DISTRÓFICO textura média fase floresta semi-sempre-verde de primeira classe.

3315 - 95% de quartzo hialino, corroidos, alguns bem descarostados, alguns levemente descarostados, a maioria com leve aderência ferruginosa, poucos com leve aderência manganosa; 2% de feldspato; 2% de ilmenita; 1% de detritos.

3316 - 99% de quartzo hialino, corroidos, alguns com leve aderência ferruginosa, poucos com aderência manganosa, os grãos se apresentam levemente descarostados e bem descarostados; 1% de feldspato, alguns com aderência manganosa; traços de ilmenita,carvão e detritos.

3317 - 97% de quartzo hialino, corroidos, triturados, alguns bem descarostados, alguns levemente descarostados, a maioria com leve aderência ferruginosa, poucos com aderência manganosa; 2% de feldspato; 1% de carvão; traços de ilmenita e detritos.

3318 - 93% de quartzo hialino, corroidos, alguns levemente descarostados, alguns bem descarostados, a maioria com aderência ferruginosa; 2% de feldspato; traços de ilmenita e detritos.

3319 - 94% de quartzo hialino, corroidos, triturados, alguns levemente descarostados, alguns bem descarostados, a maioria com leve aderência ferruginosa; 4% de ilmenita; 2% de feldspato; traços de mica, carvão e detritos.

MINISTÉRIO DA AGRICULTURA
DEPARTAMENTO DE PESQUISAS E EXPERIMENTAÇÃO AGROPECUÁRIAS
DIVISÃO DE PEDOLOGIA E FERTILIDADE DO SOLO

Perfil: ST-SUL 4 Município: EQUATORIAL

Local:

Unidade de Mapeamento: LATOSOL VERMELHO ESCURO DISTRÓFICO textura média fase Floresta semi-sempre-verde do primeira planalto

Classificação:

| Amostra do Lab. n.º | HORIZONTE | | AMOSTRA SÊCA AO AR (%) | | pH | | Equivalente de Umidade | | |
|---|---|---|---|---|---|---|---|---|---|
| | Símbolo | Profundidade cm | Calhaus > 20 mm | Cascalho 20-2 mm | água | KCl N | | | |
| 3315 | $A_1$ | 0-10 | 0 | 0 | 4.9 | 4.4 | 8 | | |
| 3316 | $A_3$ | 10-37 | 0 | 0 | 4.5 | 4.9 | 7 | | |
| 3317 | $B_1$ | 37-105 | 0 | 0 | 4.3 | 4.0 | 9 | | |
| 3318 | $B_{21}$ | -160 | 0 | 0 | 4.5 | 4.1 | 9 | | |
| 3319 | $B_{22}$ | +200 | 0 | 0 | 4.6 | 4.2 | 9 | | |

| ATAQUE POR $H_2SO_4$ D - 1,47 (%) | | | | | | ki | kr | $\frac{Al_2O_3}{Fe_2O_3}$ | P ppm |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | $TiO_2$ | $P_2O_5$ | MnO | | | | |
| 4.5 | 3.6 | 2.1 | 0.28 | 0.03 | | 2.11 | 1.55 | 2.71 | 5 |
| 5.1 | 4.1 | 2.5 | 0.34 | 0.03 | | 2.12 | 1.52 | 2.52 | 2 |
| 6.3 | 5.2 | 2.9 | 0.37 | 0.03 | | 2.06 | 1.52 | 2.66 | 1 |
| 6.9 | 5.6 | 3.2 | 0.33 | 0.02 | | 2.11 | 1.55 | 2.73 | 1 |
| 7.2 | 6.1 | 3.1 | 0.36 | 0.02 | | 2.02 | 1.53 | 3.13 | 1 |

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DIVISÃO DE PEDOLOGIA E FERTILIDADE DO SOLO

Perfil: LT - SOL 4

| COMPLEXO SORTIVO (mE/100g) Acetato de Amônio N pH 7 | | | | | | | | V % | 100.Al / Al + S |
|---|---|---|---|---|---|---|---|---|---|
| $Ca^{++}$ | $Mg^{++}$ | $K^{+}$ | $Na^{+}$ | S | $Al^{+++}$ | $H^{+}$ | T | | |
| 0.9 | 0.6 | 0.10 | 0.02 | 1.9 | 0.3 | 2.3 | 4.5 | 42 | 14 |
| 0.4 | | 0.10 | 0.01 | 0.5 | 0.9 | 1.9 | 3.3 | 15 | 64 |
| 0.2 | | 0.10 | 0.02 | 0.4 | 1.2 | 1.5 | 3.0 | 13 | 75 |
| 0.2 | | 0.02 | 0.01 | 0.2 | 1.0 | 1.3 | 2.5 | 8 | 83 |
| 0.2 | | 0.04 | 0.02 | 0.3 | 0.9 | 0.9 | 2.1 | 14 | 75 |

| C % | N % | C / N | COMPOSIÇÃO GRANULOMÉTRICA (%) Dispersão com NaOH | | | | Argila natural % | Grau de floculação | Silte / Argila |
|---|---|---|---|---|---|---|---|---|---|
| | | | Areia grossa 2-0,20 | Areia fina 0,20-0,05 | Silte 0,05-0,002 | Argila < 0,002mm | | | |
| 0.70 | 0.07 | 10 | 69 | 13 | 5 | 13 | 8 | 38 | 0.3 |
| 0.40 | 0.04 | 10 | 70 | 12 | 4 | 14 | 10 | 29 | 0.2 |
| 0.30 | 0.03 | 10 | 67 | 11 | 4 | 18 | 13 | 28 | 0.2 |
| 0.19 | 0.02 | 10 | 67 | 11 | 5 | 17 | 2 | 88 | 0.3 |
| 0.13 | 0.02 | 7 | 63 | 13 | 4 | 20 | 0 | 100 | 0.2 |

Relação textural: 1.4

SÉRIE - 317

PERFIL - MT-SUL nº 7

DATA - 11/12/67

UNIDADE - Latosol Vermelho Escuro Distrófico textura média fase Floresta tropical semi-sempre-verde do primeira classe.

LOCALIZAÇÃO - A 15 m do lado direito da estrada Mundo Novo-Iguatemi e a 20 Km de Mundo Novo.

SITUAÇÃO E DECLIVE - Perfil descrito e coletado em trincheira aberta em relevo praticamente plano, com declives de 1 a 3%.

ALTITUDE - 240 m

LITOLOGIA E FORMAÇÃO GEOLÓGICA - Arenito - Jurássico

MATERIAL ORIGINÁRIO - Arenito Caiuá

RELÊVO - Praticamente plano com 1 a 3% de declive

EROSÃO - Praticamente nula.

DRENAGEM - Acentuadamente drenado.

VEGETAÇÃO - Floresta tropical semi-sempre-verde.

USO ATUAL - Reserva florestal.

$A_0$ - 7 - 0 cm, horizonte constituido de restos vegetais em adiantado estado de decomposição.

$A_1$ - 0 - 15 cm, bruno avermelhado escuro (2.5 YR 3/4, úmido), bruno avermelhado escuro (2.5 YR 3/3, úmido amassado), bruno avermelhado (2.5 YR 4/4, seco) e bruno avermelhado (2.5 YR 4/4, seco triturado); franco arenoso; maciça porosa não coerente; "in situ" constituida por grãos de areia e fraca pequena a media granular; macio, muito friável, ligeiramente plastico e ligeiramente pegajoso; transição plana e clara; pH 5.4.

$A_3$ - 15 - 45 cm, bruno avermelhado escuro (2.5 YR 3/4, úmido), bruno avermelhado escuro (2.5 YR 3/4, umido amassado), bruno avermelhado escuro (2.5 YR 3/4, seco) e bruno avermelhado escuro (2.5 YR 3/4, seco triturado); franco arenoso; maciça porosa não coerente "in situ" constituida por grãos de areia e fraca pequena a media granular; macio, muito friável, ligeiramente plastico e ligeiramente pegajoso; transição plana e gradual; pH 5.2.

$B_1$ - 45 - 85 cm, vermelho escuro (2.5 YR 3/6); franco arenoso; maciça porosa pouco coerente "in situ"; muito friável, ligeiramente plastico e ligeiramente pegajoso; transição plana e difusa; pH 5.

$B_{21}$ - 85- 160 cm, vermelho escuro (1 YR 3/6); franco argilo arenoso; maciça porosa pouco coerente "in situ"; muito friável, ligeiramente plastico e pegajoso; transição plana e difusa; pH 5.

$B_{22}$ - 160-300 cm +, vermelho escuro (1 YR 3/6); franco argilo arenoso; maciça porosa pouco coerente "in situ"; muito friável, ligeiramente plastico e pegajoso; pH 5.

OBSERVAÇÕES - Coletada amostra de fertilidade nº F 50 MT-SUL.
Trincheira com 185 cm de profundidade, a partir daí foi usado o trado de caneco.
Raizes com diametro variando de 5 cm a 0,5 mm, predominando aquelas do diametro variavel entre 1 mm e 3 mm, assim distribuidas: abundantes no $A_1$, comum no $A_3$, poucas no $B_1$ e raras no $B_{21}$ e $B_{22}$.
Não foi coletada amostra do horizonte $A_0$.

## ANÁLISE MINERALÓGICA

MT-III 7 - LATOSOL VERMELHO ESCURO DISTRÓFICO textura média fase floresta semi-sempre-verde do primeira classe.

3330 - 90% de quartzo hialino, corroidos, com aderência de óxido de ferro; 2% de detritos; traços de feldspato e ilmenita.

3331 - 90% de quartzo hialino, corroidos, triturados, com aderência de óxido de ferro; 2% de feldspato; traços de ilmenita e detritos.

3332 - 90% de quartzo hialino, corroidos, triturados, com aderência ferruginosa; 8% de feldspato; traços de ilmenita.

3333 - 99% de quartzo hialino, corroidos, triturados, alguns levemente descorados, com aderência ferruginosa; 1% de ilmenita ; traços de feldspato.

3334 - 90% de quartzo hialino, corroidos, triturados, com aderência ferruginosa; 1% de feldspato; 1% de ilmenita; traços de concreções ferruginosas e detritos.