CLEARING AND MANAGEMENT OF LATERITIC SOILS: FIRST STEPS IN THE IMPLEMENTATION OF IBSRAM PROJECTS

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ABSTRACT

The presentation deals with site selection, site characterization, the design of experiments, and the first steps in the implementation of soil management projects, which are the main points to be covered during the IBSRAM session. They concern the two IBSRAM management networks, namely:

- Management of Acid Tropical Soils;
- Tropical Land Clearing for Sustainable Agriculture.

RESUME

DEFRICHEMENT ET MISE EN VALEUR DES SOLS LATERITIQUES:

PREMIERES ETAPES DANS LA MISE EN OEUVRE DES PROJETS IBSRAM

La discussion s'articule autour des quatre thèmes suivants :

- *choix des sites;*
- *caractérisation des sites;*
- *dessin des dispositifs expérimentaux; et*
- *premières étapes dans la mise en oeuvre des projets de mise en valeur des sols.*

Tels sont les principaux points abordés durant la session IBSRAM; ils concernent deux réseaux IBSRAM:

- *Mise en valeur des sols acides tropicaux; et*
- *Défrichement des forêts tropicales pour l'établissement d'une agriculture continue.*

Le choix des sites est la première clé pour le transfert des résultats obtenus. Il doit prendre en considération:

- *Les aspects socio-économiques qui sont nécessaires pour toute application des résultats obtenus.*
- *Les aspects physiques : systèmes sol, climat, modelé - qui doivent être vérifiés au niveau de la région en vue de s'assurer de la représentativité du site.*

La caractérisation des sites est la deuxième clé pour le transfert des résultats; elle est à la base de toute comparaison de ces résultats. La caractérisation des sites doit :

- *non seulement prendre en considération les aspects taxonomiques, mais surtout se concentrer sur les paramètres édaphiques;*
- *tenir compte des différenciations verticales et latérales des couvertures pédologiques par un échantillonage dense des parcelles;*
- *examiner la dynamique des sols liée aux mouvements d'eau sur la base d'un cycle climatique.*

Les dessins des dispositifs expérimentaux doivent prendre en compte les différenciations verticales et latérales quand elles existent.

Les premières étapes dans la mise en oeuvre des projets nationaux passent par :

- *la mise en oeuvre de la coordination des réseaux; et*
- *la mise en oeuvre des projets nationaux.*

Nous avons besoin maintenant de commencer quelques activités de réseau, même à une petite échelle.

INTRODUCTION

Land clearance and management problems in relation to lateritic soils, and IBSRAM's approach to these problems, can be summarized under the following headings:

1. site selection,
2. site characterization,
3. design of experiments,
4. first steps in the implementation of the soil management projects.

These are the main points that we have to discuss in these few days of the IBSRAM session. The International Board for Soil Research and Management Inc. (IBSRAM) has established three soil management networks during four inaugural workshops which took place in 1985. In this session we will concentrate on the two IBSRAM networks which are related to lateritic soils: 'Management of Acid Tropical Soils', and 'Tropical Land Clearing for Sustainable Agriculture'.

You have the network proposals which have been established during these workshops. Some of you have already presented national soil management projects, and others have brought project elements with them. We have now to find a way to start network activities.

For this purpose, this session will be divided into three major parts:

1. review papers on site selection, site characterization and the design of experiments, which will occupy the first day and a half;
2. working groups, which will look at the methodology which will be commonly accepted; and
3. a final plenary session which will examine the national project proposals, and will look at the first steps to be undertaken to implement these projects.

SITE SELECTION

Site selection is one of the most important aspects for soil management projects. It is the first key for the transfer of the results which are obtained. Site selection deals with two major considerations: (i) socioeconomic, and (ii) physical.

Socioeconomic considerations may appear to be very highly located in this hierarchy for soil management projects. They are the keys for the application of experimental results. The success of these networks will not be measured in terms of the sophisticated technologies which they produce; it will be measured in terms of the application of the technology which has been used. For this purpose, priority crops, priority areas, and priority for development targets in a country must be chosen, because if priorities are not carefully worked out, the results will not be of interest to anyone. This important aspect has been taken into account in the past, and most agronomic stations are well located as regards their suitability for serving practical purposes and priorities.

Investigations regarding the physical side of site selection, on the other hand, have often been poorly conducted. Too many agronomic experiments have been located on land selected by virtue of commodity availability or some other technical assets, without looking enough at the agro-environmental aspects which could determine its suitability. Poor physical characterization, or characterization done after the experiment has been completed, are very common mistakes in the tropics. This was not so important when testing germplasm, insecticides, herbicides or other plant-related practices. Good physical characterization becomes essential, however, when we look at soil management, because soils are strongly site-specific. Site selection must, then, proceed from a regional survey of the major physical aspects: climate, landform, soils.

In recent years, efforts have been made to overcome this difficulty. They concern:

1. a better characterization of the agronomic sites - but this concerns the sites and seldom the region;
2. multilocal trials, which have the advantage of erasing part of the variability due to the site specificity; but these also erase some of the results since they compare things which are not strictly comparable;
3. benchmark site projects, which are set up to validate the concept of agrotechnology transfer at the family level of the Soil Taxonomy and then to provide system analysis and crop simulation; but Soil Taxonomy is concerned almost exclusively with B horizons, whereas roots develop mainly in A horizons.

We can see that agronomists have tried to adapt more and more to the characterization of the physical environment in choosing their site, either by making a detailed characterization of the site, or by using a statistical approach, or even by choosing their site in accordance with its soil systems.

The first part of this seminar has shown the progress made in operating soil surveys. It has also shown the limit of this exercise on lateritic soil mantles regarding the scale of the surveys and the content of the soil units. One of the lessons of this seminar is that soils are not just a collection of pedons, but are organized systems which have lateral and vertical variations and which have a dynamic. Surveys should take into account our knowledge of these systems in order to give a clear image of the soil pattern.

We can see that this could be a long-term effort which might delay any further work on soil management, and in fact discourage those who might otherwise support this work. This means that in areas of interest for soil management, the existing data (with some reconnaissance surveys to complete them) should be used to identify the soil systems and locate the experimental sites. This is not an easy exercise and it may take some time to complete; but the degree to which it can be carried out accurately will determine the possibility of comparing results and of transferring these results to the surrounding farmers and eventually to other localities. Thus site selection appears as the first key to interested governments and potential donors. It secures the scientific basis of the project and allows the results to be transferred to other areas.

SITE CHARACTERIZATION

Site characterization is the second key for the transfer of the results and the basis of any comparison of these results with each another. At present, site characterization is largely envisaged as the characterization of one or more pedons in a site, with the

extrapolation of the results of the observation and analysis of this pedon being applicable to a more or less extended area. This procedure has the advantage of being rather simple, and should make it easy to harmonize. Morphologic descriptions and analysis can be standardized and thus can be compared with each other. The final product of this characterization is either a taxonomic denomination which integrates the different observed or analysed parameters, or a series of figures which are not always easy to manipulate.

These procedures present three major disadvantages:

1. Taxonomic characterization is complicated and not really designed for soil management.

   1.1 Taxonomic characterization is not always well understood. As Ray Isbell, with a touch of humour, pointed out in Townsville, Australia, "Soil classifications are known only by pedologists, and even some pedologists do not appear to understand some of their fundamental principles and limitations." So, we face a major difficulty which blocks understanding amongst pedologists themselves and between pedologists and others. The forum on Soil Taxonomy and other training courses should improve this situation in the future; and these training courses should not be restricted to pedologists but should also reach other users of soil science, and particularly agronomists.

   1.2 However, soil classifications will reach soil users if these users see a real interest in them. The integration of characters of the A horizons, where most of the edaphic parameters are located, is one of the conditions. Buol, Sanchez and others have presented technical classifications and the Fertility Capability Classification (FCC) is the most successful attempt in this field. But here again, dissemination of the principle of this system is important as well as any improvement in the system itself. One of the main outputs of these networks will probably be to test some of the characteristics of the FCC (and others) and to try to gain a better idea of what is important for plant growth. Thus a detailed taxonomic and edaphic characterization of the soils of the site, as well as a climatic and a landform characterization, are needed to enable us to compare and transfer the results of experiments.

2. Characterization with one or more pedon presumes that the area concerned is homogeneous or can be divided into homogeneous parcels. Yet we have seen that lateritic soils often present an important lateral and vertical differentiation and so are difficult to assemble in homogeneous units. Even on a rather homogeneous soil mantle, like the one derived from the tertiary sandstones of Ivory Coast and experiments

on cassava in Adiopodoume, have shown that slight variations in the soil granulometry or on the organic matter content can hide the treatment effect (de Boissezon, Bonzon, in oral communication). Thus while a general characterization is important, from a general point of view a dense sampling is compulsory to understand the lateral and vertical differentiation of the site. 'Dense' is a vague word which depends on the variability of the system, and must be tested.

3. Soil systems are not fixed systems. They present a dynamic linked to the movements of the water and of the ions and to the biological activity. Most soil observations are conducted during the dry season which hide some very important edaphic features like temporary waterlogging, ferrolysis, or porosity produced by worms. It must be stressed here that site characterization cannot be done by one visit by a pedologist, but should be based on observations made on one climatic cycle at least in order to understand the soil system dynamic.

Even with all this information, site characterization may not match exactly with an edaphic characterization because some important parameters may be forgotten or others over-emphasized. One way to overcome this difficulty is to use a test crop on the whole site with minimum inputs and to follow its behaviour uniformly. This will allow for checking site-measured parameters with vegetal parameters and will give a vegetal behaviour characterization.

DESIGN OF EXPERIMENTS

The design of experiments must take into account lateral and vertical differentiation of the site when these exist. Quadrangular designs which recut soil boundaries are unfortunate but not uncommon. They represent a waste of money because they prevent a good transfer of the obtained results, and may cast doubt on the validity of the results, as statistical processing uses Gaussian distributions which cannot fit with a differentiated substratum.

Thus we must adapt the design of experiments according to the lateral and vertical differentiation, bearing in mind the following principles:

1. On rather homogeneous soil mantles, experiments may be designed independently of the site characteristics. The small lateral and vertical variations should then be taken into account in the statistical treatment by the use of covariance factors.
2. On moderately differentiated soil mantles, areas presenting similar characteristics should be compared. But here we have to ensure what similar characteristics mean, because edaphic and analytical characteristics may differ.

3. On strongly differentiated soil mantles, like those of French Guiana, we cannot use the same methods. We may, then, have to question the statistical approach and use an observation approach (i.e. comparing site variation to plant growth and yield variations). This case may seem a little theoretical, but is in fact common since farmers often use transition areas (slopes, limits between major soil units) where nutrients and water are more available.

4. A last complicated case may also appear - the case of land covered with termite mounds or any other microvariability. Here too we need to determine how to design experiments when confronted with such a high microvariability. Should the plots be enlarged and treated as homogeneous systems, or should each microvariation be treated separately?

The designs of experiments are important, since we depend on them for the reliability of the results and their transferability. Design criteria are worth considering, and we will have an opportunity to give this matter some thought during this plenary session and in the working groups.

FIRST STEPS IN THE IMPLEMENTATION OF THE NATIONAL PROJECTS

As things are at present, we now need to consider the first steps to be taken for the implementation of these projects. During this session we will discuss:

1. the methods to be used to implement the network activity so as to establish good coordination; and
2. the projects themselves, focusing on their most important aspects.

We will then need to know how to follow up the network activities. Some donors have expressed interest in funding the coordination aspects of the two networks: Management of Acid Tropical Soils and Tropical Land Clearing for Sustainable Agriculture. By the end of the year we may have a network coordinator for these two networks. Other donors have expressed interest for bilateral projects, and sound realistic projects will be the best guarantee for any external support. External funding on a bilateral basis for national projects is mainly the responsibility of the cooperators. IBSRAM can help in refining projects and in carrying them through, but IBSRAM is not a donor and has no funds except for coordination purposes. IBSRAM can support you in your requests to donors, but cannot act in your place.

Let us now work out a strategy:

1. Some of you already have programs running in these two fields. The question is, how can we integrate them into the network - if this is what you wish to do?

2. Others would like to start some activities, have sound realistic project proposals, and have some funds to start some operations. What kind of activity could take place in the near future to start implementing these projects? Starting some activities may show the potential donors the strong interest of your country and may be a plus in future negotiations.

3. Others again may have sound and realistic projects but no funds. They must try to get funds - and in the meantime participate in the network activities, notably meetings and training courses.

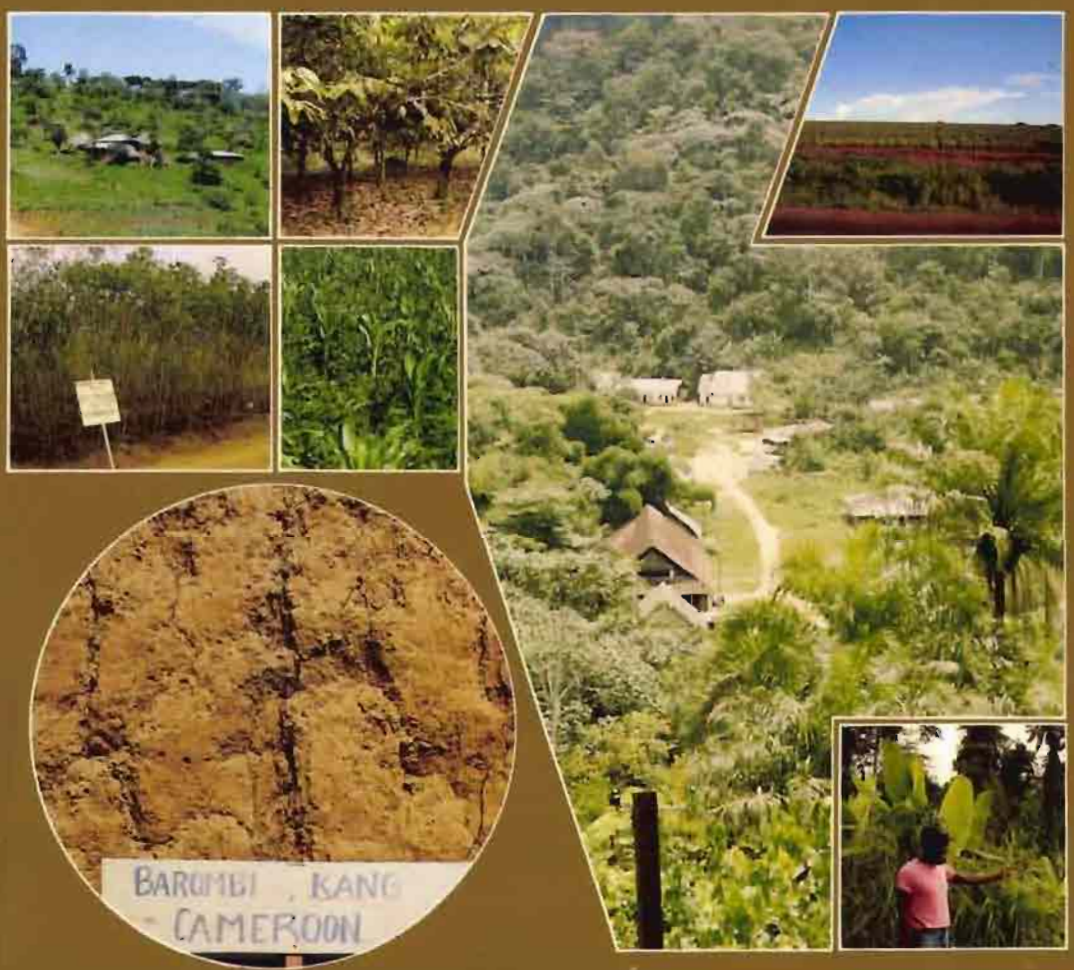
In any case, the network activity should start with a site selection (or a confirmation of the suitability of the existing site), with a site characterization, and - depending on the availability of funds - with one or more experiments. A first vegetal characterization of the site would be a reasonable start, but perhaps some limited trials on specific points could also be envisaged. This session should help us to define these points.

CONCLUSION

Inaugural workshops have occurred this past year and some project proposals have been prepared. We now need to implement these projects by harmonizing them with sound realistic objectives and starting some network activities. As has frequently been pointed out, IBSRAM is not a donor agency: it will help you to draw up good projects, to present them to donors, and to carry them out as a coordinated activity. The targets of these networks are important for the development of your country and for stimulating your enthusiasm - as we are encouraged to think by the positive reaction of many donors to requests for promoting networking activities. We must now move from conceptual projects to real programs. If we can maintain some momentum in actively working together, the success of the networks will be assured.

LAND DEVELOPMENT-MANAGEMENT OF ACID SOILS

DEFRICHEMENT-MISE EN VALEUR DES SOLS ACIDES



IBSRAM PROCEEDINGS No. 4
ISBN 974-87467-5-5

IBSRAM

Bundesministerium für Ernährung, Landwirtschaft und Forsten

ORSTOM

PROCEEDINGS OF THE
FIRST REGIONAL SEMINAR ON

LATERITIC SOILS MATERIALS AND DRES

JANUARY 21-27, 1985
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JANVIER 21-27, 1985
DOUALA, CAMEROUN

PROCEEDINGS OF THE IBSRAM SESSION ON

LAND DEVELOPMENT AND MANAGEMENT OF ACID SOILS IN AFRICA

COMPTE RENDU DE LA SESSION IBSRAM SUR LES

DEFRICHEMENTS ET MISE EN VALEUR DES SOLS ACIDES EN AFRIQUE

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IBSRAM
INTERNATIONAL BOARD FOR SOIL RESEARCH AND MANAGEMENT
PO BOX 9-109 BANGKOK 10900 THAILAND. 1987

The seminar was organized by

LE MINISTERE DE L'ENSEIGNEMENT
SUPPERIEUR ET DE LA RECHERCHE
SCIENTIFIQUE **(MESRES)**

L'INSTITUT FRANCAIS DE RECHERCHE
POUR LE DEVELOPPEMENT EN
COOPERATION **(ORSTOM)**

INTERNATIONAL BOARD FOR SOIL RESEARCH
AND MANAGEMENT Inc. **(IBSRAM)**

Co-sponsored by

BUNDESMINISTERIUM FUR
WIRTSCHAFLICHE ZUSAMMENARBEIT **(BMZ)**
FEDÉRAL REPUBLIC OF GERMANY

Correct citation: International Board for Soil Research and Management Inc. (IBSRAM), 1987, Land Development and Management of Acid Soils in Africa, Proceedings of the IBSRAM session of the first regional seminar on Lateritic Soils, Materials and Ores, Douala, Cameroon, January 21-27, 1986.

ISBN 974-87467-5-5

Printed in Thailand