IBSRAM's SOIL MANAGEMENT APPROACH

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Abstract

The IBSRAM target areas, namely (i) management of Vertisols, (ii) management of acid tropical soils, and (iii) tropical land clearing for sustainable agriculture are defined, and the regional networks which have been initiated are described. Special attention is then given to the multidisciplinary approach, and the organization of the networks for the three target areas.

Core experiments and support trials are discussed, together with agroecological and socioeconomic considerations for achieving a sustainable cropping system.

Finally the need for the employment of standard and consistent methodologies is indicated, and the necessary features of such methodologies are presented. They are: adaptation to soil management research needs, simplicity, accuracy, replicability, and the ability to adapt to new situations when required.

Résumé

L'APPROCHE IBSRAM POUR LA GESTION DES SOLS

Les priorités de l'IBSRAM, à savoir (i) la gestion des Vertisols, (ii) la gestion des sols acides tropicaux, et (iii) les défrichements tropicaux pour une agriculture continue et viable, sont présentés, ainsi que leurs associations dans des réseaux régionaux. Une attention particulière est portée à l'approche multidisciplinaire et l'organisation des réseaux sur les trois sujets prioritaires.

Les experimentations centrales et les essais complémentaires sont discutés, en même temps que les considerations agroécologiques et socioéconomiques nécessaires pour l'établissement de systèmes de culture continus et viables.

Finalement le besoin d'utiliser des méthodes standardes et homogènes est

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indiqué, ainsi que les grandes lignes de ces méthodes, a savoir : l'adaptation aux nécessités de la recherche pour la gestion des sols, la simplicité, la précision et la possibilité d'adaptation à des situations nouvelles quand elles se présentent.

Introduction

The overall goal of the International Board for Soil Research and Management (IBSRAM) is to promote improved and sustainable soil management technologies in order to remove or reduce soil constraints to food and other agricultural production in developing countries. The three objectives of IBSRAM are:

1. By the network approach, to validate or test existing knowledge of soil management, and to promote applied soil management research by national agronomic institutions.
2. To disseminate widely information about validated technologies - through newsletters, other publications, training courses, computerized data bases, and workshops.
3. To strengthen national agronomic institutions by network and information activities, and by providing technical support.

Programmes on soil management, to be efficiently conducted, require a good knowledge of soils and their environment, of the farmers in the target-areas and their practices, and of the latest developments in soil management research. In order to take all these requirements into account, IBSRAM - in association with its cooperators - has developed during the past three years a soil management approach which delineates the framework of each network, the type of experiments to be conducted, and the methodologies to be employed.

Framework of the Networks

The first issue which arose in establishing the soil management networks was the question of defining the target areas. This was done by the IBSRAM Board of Trustees after the International Workshop on Soils held in Townsville, Australia (ACIAR, 1984), and the selected areas were considered in more detail during four subsequent inaugural workshops (IRRI, 1985; IBSRAM, 1985a, 1985b, 1985c). Three main areas were viewed as priority targets for the IBSRAM soil management networks.

* the management of Vertisols (MOV)
* the management of acid tropical soils (MATS)
* tropical land clearing for sustainable agriculture (TROLACSA).

These three topics are viewed as global ones by IBSRAM, and constitute, either alone or in conjunction with each other, the subject areas of the three current regional soil management networks:

- o Land Development and Soil Management in Asia and the Pacific (ASIALAND),
- o Management of Vertisols in Semi-Arid Conditions in Africa (MOVUSAC), and
- o the network which is being proposed at this seminar, which is concerned with the management of acid soils in humid Africa, and which may include management of acid soils projects and tropical land-clearing projects.

Another point which was emphasized during the IBSRAM workshops was that soil management research is more than soil research: it relates to soils, crops, farmers, and national policies. Therefore a multidisciplinary approach must be taken to tackle soil management problems. Soil has to be studied holistically, with emphasis on the surface layers and their variability in relation to their suitability for agricultural production. Crops have to be monitored in relation to each other as cropping systems - or more precisely as farming systems. Since farmers are involved, the practices of farmers and the constraints they face have to be known in order to test new farming systems, and national policies with regard to the lands and crops to be employed have to be assessed before starting an experiment. All of this means that soil management experiments must involve specialists in various disciplines if they are to result in the development of improved practices for the cooperators.

The actual organization of the networks was the third general issue considered during the four inaugural workshops. The relations between the cooperators, IBSRAM, and donors have been clarified. Cooperators are the people responsible for initiating and operating the national soil management research projects. IBSRAM establishes a framework for the network, in conjunction with the cooperators, but the research to be conducted will be carried out by the cooperators. The investigations must be relevant both to the country's objectives and to the network's aims. IBSRAM will not commission an outside organization to carry out a research project, but rather will expect the cooperating country itself to conduct the research as a voluntary commitment. It is understood that some additional funds may be needed by the cooperators, and in this matter IBSRAM will lend its support to the cooperators in the development of the project plan and in seeking such supplementary funding as may be required. However, external funding should, in IBSRAM's view, be at a very modest level, and should be subordinate to the national funding so that the genuine interest of the cooperating country is assured and demonstrated.

The mechanism being developed for the approval of project proposals consists of the following steps: (i) presentation by the cooperators of the project proposals to IBSRAM; (ii) a review of the proposals in collaboration with the Network Coordinating Committee (NCC); and (iii) acceptance of the refined project proposals by the IBSRAM Board. When necessary IBSRAM will help cooperators who seek donor funding to start or complete their projects.

The criteria of approval are the following: (i) projects need to conform to the network's objectives; (ii) projects must be technically acceptable, i.e. employ the approach and methodology agreed to by the network at large; (iii) projects need to be scientifically and economically acceptable; and (iv) the cooperators should already be involved in research of the type proposed, or be able and willing to invest in the projects as matters of national priority, and assure national support in terms of human, physical and financial resources.

Type of Experiment

One of the main issues which arose during our recent seminar on Soil Management under Humid Conditions held in Khon Kaen, Thailand (IBSRAM, 1986a), and in the subsequent seminar on Vertisols held in Nairobi (IBSRAM, 1987a) was the type of experiment IBSRAM networks should undertake. A distinction was made between two types of experiment:

- **common-core experiments**, in which cooperators are normally expected to participate and thereby gain reciprocal benefits, and in which known successful techniques are tested in a number of different situations;
- **support trials, or component experiments**, which take place within a common framework, but which are activities of particular cooperators and serve to fill gaps in present knowledge at a national or regional level.

The distinction is not simply academic, but relates in a very practical sense to the IBSRAM strategy. An IBSRAM core experiment is intended to test the performance and sustainability of farming systems. It uses our present knowledge or predictions with regard to fertilizer and lime requirements, crop varieties and management, the levels of inputs acceptable by farmers, and priorities in terms of crops and the land to be developed.

Participants discussing the management of acid soils experiments in Khon Kaen defined the following minimum number of situations which needed to be evaluated and compared for the common-core experiment of that network:

- The normal practice of the local farmers, which is usually characterized by mono- or mixed cropping followed by a fallow period. This treatment is used as a reference for the others.
- A treatment using low-input technology in which acid-tolerant species, including a legume, are used in intercropping, successive cropping, or other cropping systems, and where the low inputs could consist of a small amount of fertilizer (mainly phosphorus, perhaps with some calcium and magnesium as nutrients).
- A treatment using high- or recommended-input technology which might entail, in addition to high-yield varieties, (i) pH correction by an appropriate liming, and (ii) use of fertilizer as determined by soil tests or field experiments. In this treatment, highly productive plant species are used, either in a crop rotation or by adopting new cropping-system techniques.

Many modifications of this framework are of course possible, and the introduction of ley-arable cropping systems, agroforestry, and more specifically alley cropping, are of course acceptable innovations. The rates of application of inputs may be determined according to current local information and recommendations, and the acid-tolerant germplasms used are those which are locally available. Later, adjustments may need to be made as new knowledge is obtained.

At this stage, no attempt is made to have a uniform experiment with the same input and cropping system for all the cooperators in a network. Initially local practices and recommendations will be used. The only exception to this heterogeneity is that there should be one common crop to all cooperators - say maize or upland rice - so as to facilitate comparisons.

In fact, the need to be able to compare farming systems is basic. However, it is difficult to compare yields of cassava with yields of groundnuts. It has therefore been suggested that a conversion to "wheat equivalent" could be used, as proposed by the *Atlas of African Agriculture* (FAO, 1986). However, since we are comparing farming systems it may be preferable to convert yields into cash terms - i.e. their cash value at harvest time. The value of different yields of a cropping system can be added together to determine the yearly outputs of the tested systems. As for inputs to the system, there is a need to consider direct investments (lime, fertilizer, seeds, pesticides and herbicides) and manpower, bearing in mind that the availability of manpower may vary at different times of the year and could be a critical issue for the success of a cropping system at the farmer's level. Such an evaluation will enable determination of the socioeconomic sustainability and acceptability of the tested systems.

The main problem with such a socioeconomic appraisal is that although inputs and outputs can be measured, they do not indicate the way the total system functions, and this limitation may inhibit improvement in the general operation. A knowledge of changes in soil fertility, of the residual effects of the treatments applied to the soil, or of the risks of soil degradation are essential in this connection. Monitoring these aspects will enable technologies to be adapted so as to achieve agroecological sustainability. It is only when the socioeconomic and agroecological sustainability of a farming system have been assessed that the system can be properly considered as being suitable for general extension and promotion to farmers.

Support trials or component experiments are more like classical agronomic experiments. They tend to correlate a fertility component or a crop variety with yields. In some cases they may be essential, as big gaps may exist in the local knowledge. Lime requirements, fertilizer needs, or adapted crop varieties are all too often far from being properly understood, and consequently the recommendations issued are not always satisfactory. Trials are necessary to adjust recommendations to suit local conditions; their results may subsequently be incorporated in the core experiment.

More basic research, such as the work to be carried out on the forms of aluminium in the soil, on erosion rates, or on the dynamics of the organic matter, is also needed. This research, which needs strong laboratory backup, may be conducted with the help of international agricultural centres or universities in developed countries. Such cooperation should prove fruitful for both partners, and will help establish international contacts. Basic research is highly desirable, as there are big gaps in our knowledge on the management of tropical soils, but if conducted without the core experiments, investigations of this sort may become an unaffordably long process, using up much of the cooperator's efforts and resources while detracting from his main aim - which is to obtain, in a reasonable length of time, viable improved technology to be transferred to the farmers.

Methodology

As three IBSRAM soil management networks have been launched, the need for a commonly accepted methodology is now a matter of some urgency. Site selection and characterization, the design of experiments, and the monitoring of farming systems

have been discussed in our last three regional seminars (IBSRAM 1986a, 1986b, 1987a). It is now time to review and to finalize these recommendations. A first draft of a report setting out the suggested ordering of previous recommendations has been prepared and is being circulated. It will be discussed in due course before its final adoption.

The first question, however, which might reasonably be asked is: why do we need standardized methodologies for the IBSRAM networks? Many guidebooks provide soil descriptions and methods for soil analysis; some also discuss the relevant environmental issues and socioeconomic considerations. Why, then, should we not merely use those particular methodologies with which we are already familiar?

The answer is that methodologies should be suited to the aim of the research, and standard procedures are not necessarily the best way of achieving a particular goal. "Routine" soil descriptions and analyses have long been performed in soil science and agronomy, sometimes without sufficient regard to their significance in relation to agricultural improvements. As a consequence, too many agronomists hardly utilize these routine operations except as background information, and often the interrelations between soil and crops are not adequately considered.

The acquisition of soil and environmental data is an expensive process. If the data requirements are not carefully chosen, excessive costs may overload a research budget. For a methodology to be appropriate, it must be suited to the research objectives. This means that for soil management projects emphasis must be put on characterization of the topsoil and its variability, on the environmental parameters which affect plant growth, and on the socioeconomic background which is related to agriculture. Standard analyses often have little relevance for the assessment of soil fertility. For example, effective cation-exchange capacity is much more relevant in terms of agronomy than cation-exchange capacity conventionally measured after extraction by ammonium acetate at pH 7.

The second set of requirements for good methodologies are simplicity, accuracy and replicability. IBSRAM cooperators often have limited laboratory facilities, and since methodologies must be applicable by all, they should involve the use of only a few different extractants, the determination of easily appraisable visual characters, and simple questionnaires. Training, correlation, exchange of information and samples, and the use of control laboratories are important features of the cooperative system which need to be applied.

Finally, methodologies must be open-ended. New results may bring a better assessment of some parameters, and a shift may be needed towards new analytical methods. Allowance must be made for incorporating new elements into the system - something which is especially important to bear in mind when choosing the data base system.

Conclusion

During the last two years, the targets, the orgahization of the networks, the type of experiment to be conducted, and the methodologies to be used have been extensively discussed. We now have to fit this scheme to the proposed Network on the Management of Acid Soils in Humid Africa, and see what modifications are needed and what

aspects of the methodologies can be fully accepted. As cooperators, you will have to fit your project proposals to the cooperative rationale, and see to what extent they conform to the networking principles which have been laid down, and in what ways they need to be changed in order to be integrated into a coordinated framework. This seminar is designed specifically with this task in mind, and the future of the network will depend very largely on the decisions which are reached during the course of this meeting.

The next step will be to decide how to implement the network's plans, and for this we will need to work together to make some joint assessment of how our national plans can benefit from cooperative efforts. The coordination of the network is already funded, which will of course help in achieving smooth network functioning. We now need to find ways to implement your particular projects, to organize training sessions, and to facilitate the transfer of information. We are optimistic that the ideas and the support needed to make the network successful will be forthcoming.

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THE IBSRAM ACID TROPICAL SOILS NETWORK: A PROGRESS REPORT

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Abstract

Since its inaugural workshop, IBSRAM's Network on the Management of Acid Tropical Soils has made significant progress. The network addresses the urgent need to transfer appropriate soil management technology for sustained production of Oxisols and Ultisols in the humid tropics and acid savannas. .Network activities to date, sponsored by IBSRAM or TropSoils, have involved 37 countries in Africa, Latin America, Asia and Oceania, which together cover about two-thirds of the world's acid tropical soils areas. A total of 63 national institutions have been represented in the various workshops - along with many donor agencies, international organizations, and universities from the developed nations. Fourteen countries have submitted project proposals to IBSRAM. Although none have been funded to date, 15 countries have already initiated site selection and six actually have experiments on the ground. Thirty-one front-line soil scientists have received on-the-job training through a TropSoils network.

The principal research topics are pedology-fertility relationships, management of soil acidity, phosphorus fertilization, soil dynamics in different cropping systems, and organic-input use. The soil management options include low-input cropping systems, agroforestry, intensive crop production systems, and pastures. Substantial progress has been made on common methodologies for site characterization and edaphic parameters. Strong collaborative linkages have been developed with many institutions conducting research on these soils. IBSRAM's Acid Tropical Soils Network is now ready for a full implementation phase.

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