

# SOIL MANAGEMENT FOR SUSTAINABLE AGRICULTURE : AN IBSRAM COLLABORATIVE, ADAPTIVE RESEARCH APPROACH<sup>1/</sup>

## ABSTRACT

Soil management, cropping systems and farming systems researches are new fields of investigation which require a multidisciplinary approach. These research fields have attracted a great deal of interest in recent years due to the migration of low-income populations into marginal lands. Adaptive research, using current knowledge and adapting it to specific environments, is the first priority. This research is concerned to test different low-and high-cash input options and to assess their relative profitability and sustainability. National Agricultural Research Systems are in the best position to undertake this adaptive research. However they often need strengthening by complementary financial support, information and training. Networks and particularly collaborative research networks offer the best answer to this challenge. This type of network needs specific objectives, a common type of experiment and methodology, and supervised coordination. The establishment of a network may take some time, example as the development of the IBSRAM ASIALAND network has shown. Three years have been needed to establish it, largely as a result of the difficulties encountered in preparing the national proposals and into procuring donor support it.

## บทคัดย่อ

การจัดการดินระบบการปลูกพืช และระบบการทำฟาร์ม เป็นแนวทางการศึกษาใหม่ในด้านการเกษตรที่ต้องการความร่วมมือระหว่างนักวิชาการแขนงต่าง ๆ การศึกษาลักษณะนี้ ได้รับการสนใจมากขึ้นในปัจจุบัน เนื่องจากประชากรที่ยากจนอพยพเข้าไปทำมาหากินบนที่ดินที่มีคุณภาพต่ำมากขึ้น การวิจัยเพื่อปรับเทคโนโลยีที่มีอยู่แล้ว ให้สามารถเข้ากับพื้นที่ที่มีสภาวะแวดล้อมแตกต่างกันได้ เป็นงานที่มีความสำคัญเร่งด่วน การวิจัยประเภทนี้ เป็นการเปรียบเทียบผลตอบแทน และความยั่งยืนของเทคโนโลยีที่ต้องการการลงทุนสูง กับที่ต้องการการลงทุนต่ำ ระบบงานวิจัยทางการเกษตรของแต่ละประเทศ อยู่ในฐานะที่เหมาะสมที่สุดที่จะดำเนินการวิจัยในลักษณะนี้ แต่มักจะต้องการความสนับสนุนทางการเงิน ข้อมูล และการฝึกอบรม วิธีที่จะทำการวิจัยแก้ปัญหาที่ท้าทายอยู่ขณะนี้ที่ดีที่สุด คือ การสร้างข่ายงานวิจัยและร่วมมือกันดำเนินงานซึ่งจะต้องมีวัตถุประสงค์เฉพาะ มีการทดลอง วิธีการที่สอดคล้องกัน และมีการประสานงานกันทางด้านวิชาการ การสร้างข่ายงาน อาจจะต้องใช้เวลา ตัวอย่างเช่น การสร้างข่ายงาน ASIALAND ของ IBSRAM ซึ่งต้องใช้เวลาราวสามปี ทั้งนี้ เนื่องจากความยากลำบากในการเตรียมข้อเสนอของแต่ละประเทศ และการติดต่อทางองค์การที่จะสามารถให้การสนับสนุนด้านการเงิน

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The need to increase and diversify crop production for a burgeoning population, while at the same time preventing land degradation, is one of the major challenges facing countries like Thailand in the final years of this century. To work toward this goal, new scientific approaches have been developed in recent years, which involve research on soil management, cropping systems and farming systems. All these different aspects of agricultural development rely on the integration of soil, agronomic; and socioeconomic considerations, which are only differentiated by their relative emphasis on one or other of these topics.

The International Board for Soil Research and Management (IBSRAM) was created in 1983 to address soil management problems and especially those arising in relation to marginal lands - upland acid tropical soils, Vertisols and land previously covered with forest, especially sloping lands. The reason for the choice of these primary targets was that in the past most agronomic research concentrated on fertile soils, while at present many poor farmers have to migrate towards marginal lands of one sort or another. The transfer of new technologies has been slowed down by the inherently low soil fertility of these lands, by the great variability of agroenvironments which they exhibit, and by the high degree of site specificity which needs to be taken into account. Shifting cultivation remains the normal soil management practice in these areas, and population pressure has led to an extension of the cultivated areas at the expense of the natural forest, to a shortening of the fallow period, and hence to land degradation.

The main task which IBSRAM has faced since its initiation is to discover how to the best ways of undertaking soil management research in these marginal areas.

## ADAPTIVE VS. STRATEGIC RESEARCH

The research priorities for soil management are of two kinds : adaptive research, using current multidisciplinary knowledge and adapting it to specific environments; and strategic research, generating new knowledge, mainly mono-disciplinary, on discrete components affecting soil management. This may be a simplistic distinction, as adaptive research relies to some extent on strategic research - in the course of assessing the sustainability of the tested systems for example. Nevertheless the distinction is useful, since tests relating to adaptive research can be extended through on-farm testing to farmers, while strategic research is a longer procedure.

Most of the agricultural research in developing countries has been of the strategic type and has not been followed by an adaptive programme. Results of research on the discrete components affecting soil fertility have, until now, had little practical effect on farmers' practices. In Thailand farmers only use about 100-150 kg of fertilizer per hectare of cultivated land, and the average yields of rice, one of the major Thai exports, are still very low. There is an urgent need to adapt and test existing knowledge in various technological combinations and in different agroenvironments. Combinations of improved practices may not be ideal, but until more refined methods are evolved through adaptation and modification, they represent the best options available at present time. Acceptable combinations will enhance the sustainability of crop production in relation to the level of inputs which the farmers can afford.

Adaptive research must, of course, provide a range of options. High-cash input technologies have often been favoured by scientists, as they generate higher and more spectacular yields as compared to traditional practices. However, farmers very often lack adequate cash or credit to employ expensive technologies. Instead of using high-cash inputs, it may be advisable to use improved varieties adapted to marginal conditions - acid tolerant, drought-resistant, and nitrogen fixing varieties - which can grow under the constraints of the local soil and economic conditions which farmers face. However, there is a need to assess the suitability, adaptability and productivity of improved crop strains and their sustainability. Testing farming systems under low- and high-cash input conditions is one of the most urgent issues in the concept of practical improved soil management.

## RESEARCH IMPLEMENTATION

The current challenge faced by scientists involved in agronomic research in the tropics is how best to combine in practical production terms, the use of marginal lands, site specificity, low-cash inputs, and adaptive research to develop improved and sustainable soil management systems. There is also a question of how to assist the existing research systems to cope with this challenge.

Traditionally agronomic research stations have been established on fertile soils with easy access and superior facilities. The shift to marginal lands is a new challenge for agronomic research, and especially the International Agronomic Research Centres (IARCs), which have previously concentrated mainly on crops. However, in the last few years, IARCs have become aware of the need to address new agroenvironments and have given more attention to the development of farming systems research and to outreach programmes intended to identify acceptable improved technologies. There is the possibility, through, that this effort could duplicate the work of National Agricultural Research Systems (NARS)

and could possibly detract from the still very necessary strategic efforts of the IARCs. In fact, NARS are in a better position than IARCs to conduct adaptive research on farm systems, as pointed out by the CGIAR (1985) when they state : "Because of the inherent specificity of farming systems research, it should logically be implemented by national research programmes"

However the NARS often lack adequate operating funds and may not know of new developments or may not have suitable training. The Asian Development Bank (ADB, 1987) in an overview of agricultural research in Asia, has indicated the urgent need for strengthening the NARS, for cooperation between the NARS and the IARCs and for training and information. In the ADB report, farming systems and soil management research are considered to be major priorities.

## COLLABORATIVE NETWORK APPROACH

It is implicit in the idea of adaptive research that the NARS have to play a major role in such undertakings. As indicated earlier, limited staff and financial resources are major constraints on NARS operations, and it is in order to minimize these constraints that the network concept has been put forward. This approach enables participants to be informed of existing knowledge and promotes the adaptation of this knowledge to local conditions. Networks lead to the sharing of new findings by NARS working on the same subject and help to coordinate their efforts.

Greenland *et al.* (1987) have recently described three main categories of networks :

- Information Exchange (IE) networks : The function of IE networks is to facilitate the exchange of ideas, methodologies and research results.
- Scientific Consultation (SC) networks : SC networks are set up to promote collaborative efforts in planning research activities, and in discussing research results. These networks usually involve regular meetings of the participants and may provide different approaches to a common problem.
- Collaborative Research (CR) networks : In CR networks, countries collaborate in joint planning and implementation of research projects, in the monitoring, testing and validation of research, and in sharing the results for the benefits of all the participants. In a CR network, a common research format is often used so as to simplify the comparison of data. A coordinating centre normally facilitates the distribution and interchange of materials for evaluation in the network.

IBSRAM network has chosen the CR type of network for its soil management operations, creating networks which involve a common research format and a coordinating unit.

Certain conditions are necessary to establish a successful CR network on farming systems or soil management, and notably the following :

- a common interest from all the participants on specific objectives;
- a common type of experiment to be undertaken by all participants, which is agreed upon during an initial workshop;
- a common methodology accepted and implemented by all;
- a coordinating body which helps collaborators in the preparation of their own projects and in undertaking of their experiments;
- the organization of an information exchange system and of training activities specially designed for the implementation of the network; and
- regular meetings of the collaborators who will exchange their results and ideas and eventually adapt their programmes to new findings.

## THE ASIALAND NETWORK

The organization of IBSRAM's Land Development and Management in Asia (ASIALAND) Network can be given as an example. During three inaugural workshops held in 1985, IBSRAM and its collaborators defined three majors targets for collaborative research networks :

- management of acid tropical soils (IBSRAM, 1985a);
- management of Vertisols (IBSRAM, 1985b); and
- tropical land clearing for sustainable agriculture (IBSRAM, 1985c).

During a regional workshop held in Khon Kaen, Thailand, in October 1986, the organization of the Asialand network, the type of experiment to be conducted, and the methodologies to be employed were have been discussed and

agreed upon (IBSRAM, 1986). Since then, the project proposals have been prepared and a first implementation is taking place on the tropical land clearing aspect with emphasis on the management of sloping lands. Five collaborators are taking part in this first effort : Indonesia, Malaysia, Nepal, Philippines, and Thailand. The main difficulties have been to finalize related project proposals which are sound and practical, and to interest a donor in the subject. Collaborators have been asked to clarify their ideas and to accept a common approach, and the coordinating agency has been helping collaborators in their initial work and in explaining the relevance of the projects to prospective donors. It is now expected that with clear project proposals and with the funding of the network, the implementation of the projects will proceed smoothly. However, one must not underestimate the difficulties of this type of exercise. It may well be a long and lengthy process, but is a worthwhile effort which can be extremely profitable for the researchers and for the output of the network in terms of agricultural development.

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