

Scientific registration n°: 2711

Workshop : B

Presentation: oral

The Soil, Water, and Nutrient, Management Programme – An Overview

Le programme de gestion du sol, de l'eau, de la nutrition – Vue d'ensemble

CRASWELL Eric T(1), LATHAM Marc(2)

(1) International Board for Soil Research and Management, PO Box 9-109, Bangkhen, Bangkok 10900 Thailand

(2) Centre National d'Études Agronomiques des Régions Chaudes, 1101, avenue Agropolis, BP 5098, 34033 Montpellier, cedex 01, France

International concern about the degradation of the Earth's land and water resources reached a peak at the time of the UN Conference on Environment and Development in Rio de Janeiro in 1992. The resultant Agenda 21 highlighted the need for a shift in research and development priorities to emphasise the sustainable management of resources. In the field of agricultural research, the successes of the green revolution earned breathing space for such a reorientation. Nevertheless, the international and national research efforts to address the sustainable management of soil and water resources remained under-funded, in part because the impact of soils research could not be so clearly demonstrated as that of plant breeding.

Donor agencies consequently commissioned IBSRAM to develop a position paper to assess the problems of research in this area and recommend a new agenda. The paper spawned a concerted international effort to re-invigorate, re-orient and re-organise international research through the Soil, Water, and Nutrient Management Programme (SWNMP). The programme, which is part of the agenda of the Consultative Group on International Agricultural Research, is convened by IBSRAM and the International Centre for Tropical Agriculture (CIAT), and focuses initially on four major constraints to sustainable agriculture — nutrient depletion, inefficient water use in dry areas, acid soils and water erosion of soils. Each problem is being tackled by a consortium of national agricultural research and extension systems, non-government organisations, advanced research organisations, and international agricultural research centres.

The key to success of the SWNMP is the new research paradigm based on farmer participation, a landscape perspective, interdisciplinary research approach, institutional strengthening, development of appropriate policies, and sharing of research methodology. The consortia share innovative tools for sustainability and impact assessment, using geographic information systems and decision support systems. In addition to improved and appropriate technologies, the SWNMP is delivering new research tools and indicators, enhanced institutional capacity, and scientifically sound and relevant information to help decision makers tackle intractable land degradation problems.

Keywords : inter-disciplinary, participatory, land degradation, catchment approach

Mots clés : interdisciplinarité, participation, dégradation des terres, approche bassin versant

Scientific registration n°: 2711

Workshop : B

Presentation: Oral

The Soil, Water, and Nutrient, Management Programme – An Overview

Le programme de gestion du sol, de l'eau, de la nutrition – Vue d'ensemble

CRASWELL Eric T(1), LATHAM Marc(2)

(1) International Board for Soil Research and Management, PO Box 9-109, Bangkok, Bangkok 10900 Thailand

(2) Centre National d'Études Agronomiques des Régions Chaudes, 1101, avenue Agropolis, BP 5098, 34033 Montpellier, cedex 01, France

Introduction

Sustainable land management is now the focus of many national and international programmes in the developing regions. Many of these programmes grew from concerns expressed at the UN Conference on Environment and Development in Rio de Janeiro in 1992. The disturbing reality is that within 20 years the world's population will grow to 7.5 - 8.5 thousand million (Fischer and Heilig, 1997). The consequent increase in demand for food will require a 40% increase in cereal production between 1993 and 2020 (Pinstrup Andersen et al., 1997). This increase must be achieved against a background of continued degradation of land and water resources and of inappropriate technologies and policies to increase food production where it is needed most (Scherr and Yadav, 1996). Although precise information about the aggregate impacts of land degradation on global food production is not available, degradation processes such as erosion, salinisation, and nutrient depletion significantly affect the costs of present and future food production and can have high cost offsite effects that receive little attention from current agricultural research programmes (TAC, 1996).

Agenda 21 called specifically for improvements in the knowledge base for sustainable production, including an ability to improve long term predictions and to build scientific capacity. The Agenda also emphasised the need to determine priorities for research at a range of levels from national to global and to develop a policy framework for sustainable land management. Research on land and water resources has been relatively neglected by the Consultative Group on International Agricultural Research (CGIAR) which allocates 17% of its resources to this field (TAC, 1996), and generally lacks the appropriate skill mix to tackle some aspects of the problems. Research in this field is nevertheless the subject of a large number of national and bilateral programmes outside the CGIAR. As exemplified by the presentations at the Zschortau meeting (IBSRAM/DSE, 1995), national agricultural research and extension systems (NARES) invest considerable efforts to catalogue their national land and water resources, develop land use plans, and promote sustainable land and water management through research

and development programmes. Furthermore, advanced research organisations (AROs) in Europe, Australia and North America have major research programmes to address the problems of management of land and water resources. The Zschortau meeting defined a mechanism for harmonising this global effort and led to the Soil, Water, and Nutrient Management Programme (SWNMP) which is the subject of this symposium.

This paper presents an overview of the background, scope and progress of a global research programme on Soil, Water and Nutrient Management that is a system-wide programme of the Consultative Group on International Agricultural Research. The paper introduces the SWNM programme, details of which are described by the other 6 papers in this symposium.

The Problems

The long term productivity of land is adversely affected by a wide range of degradation processes that have been catalogued by Oldeman et al. (1990). Their data suggest that the proportion of agricultural land degraded is 38% in Asia, 65% in Africa and 51% in Latin America. These aggregate figures indicate the overall severity of the problem, but research planning requires more information about hot spots where urgent action is needed. The IBSRAM position paper defined the priorities for research as follows:

Table 1: Research priorities (summarised from Greenland *et al.*, 1994)

| By components | By areas |
|--|---|
| <ul style="list-style-type: none"> • Nutrient losses and soil acidity • Land degradation • Low level of application of knowledge • Lack of long-term experiments • Distension of farmers' decisions by market and policy decisions • Loss of soil structure • Loss of organic matter • Inadequate methods of diagnosis of SWNM problems • Inappropriate methods of water management • Inadequacy of the information base | <ul style="list-style-type: none"> • Land and water management in mountains and steeplands • Land and water management in desert margins • Land and water management in irrigated areas • Management of acid soils • Factors of productivity in wetlands • Integrated inorganic/organic farming methods from software • Alternative to shifting cultivation for humid forests. |

Most of these problems are globally important, yet the ongoing research effort to tackle the problems is fragmented. In order to harmonise efforts across regions and define research priorities more effectively, an improved information base is needed to pinpoint problem areas. One approach is to define resource management domains (RMD) that encompass the environmental and socio-economic characteristics of a recognisable unit of land (Dumanski and Craswell, 1998). A key feature of the RMD approach is the integration of spatially defined data on social, economic, landscape, climate and soils factors. As Latham (1998) points out, the RMD concept is particularly valuable for the transfer of technologies from one location to another.

The Need for a New Approach

Past research on soil constraints to food production focused on the biophysical problems and the technical solutions (IRRI, 1979). They aimed at attaining maximum production through technological improvements designed largely without regard to farmers' constraints. Furthermore experimental sites were selected without carefully considering the possible geographical extension on the results. Consequently, farmers have not used the results of much of this research. Recognition of this failure led to a re-examination of approaches to research on sustainable land management. A new research paradigm was described by Greenland *et al.* (1994). The key elements of the new paradigm are listed in Table 2.

Table 2 Key elements of the new paradigm for research on sustainable land management

| Element | Approach |
|--------------------|---|
| User orientation | Participatory, community based at all stages from planning to implementation. |
| Policy | Focus on policy and institutional issues that influence farmer and community decisions. |
| Equity | Consideration of equity, including gender analysis, in research planning and implementation. |
| Landscape | Integration of people, soil and water at every scale from plot to catchment. |
| Research intensity | Linking strategic, applied and adaptive research with technology development and participatory dissemination. |
| Knowledge | Reliance on both indigenous and scientific sources. |
| Orientation/goals | Linking increased productivity with natural resources conservation. |

The Need for a Focused Effort

Based on the recommendations of the Greenland *et al.* (1994) position paper, IBSRAM and the International Centre for Tropical Agriculture (CIAT) initiated and facilitated the launch of the SWNM programme. Four priority issues were selected by CGIAR centre directors after a careful evaluation of the magnitude of the problems and of the likelihood to reach a solution in a reasonable length of time. These four priority issues led to the constitution of four consortia and of a proposal submitted to the CGIAR and accepted in 1996. The four consortia address the following issues:

- Nutrient depletion in the humid savannahs of Africa, with two major thrusts: (i) the possibility of investment in nutrient recapitalization, and (ii) nutrient cycling through organic matter. The consortium is led by two international centres - the International Fertilizer Development Center (IFDC) and the Tropical Soil Biology and fertility Programme (TSBF) - and two NARES - Ahmadu Bello University (Nigeria) and the Kenyan Agricultural Research Institute (KARI) in Kenya.
- Management of acid soils in Tropical Latin America. The consortium aims at developing improved agropastoral and crop rotational systems on nutrient poor

acid soils, identifying land quality indicators for these two systems and building a data base and a GIS for these land-use systems. CIAT is the lead international centre whereas Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) in Brazil is the lead NARES.

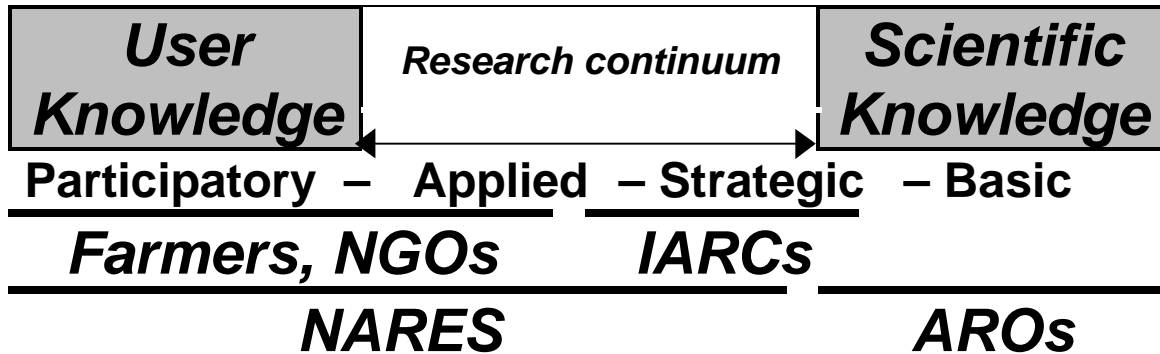
- Managing soil erosion in humid tropical Asia. The consortium aims at developing land-use management systems that will be profitable and at the same will reduce the on-site and off-site effects of soil and water degradation. It aims also at providing a reliable information base for policy and decision-making. IBSRAM is the lead IARC whereas Philippine Council for Agriculture, Forestry, and Natural Resources Research and development (PCARRD) in the Philippines was the initial lead NARES.
- Optimising soil water use in arid and semi-arid parts of Africa. The consortium aims at increasing the soil water supply through water harvesting, at increasing the water efficiency through proper soil management, and improving the quality and the reliability of the water supply. The two lead international centres are International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the International Center for Agricultural research in dry Areas (ICARDA) whereas the Institut d'Économie Rurale (IER) in Mali is the lead NARES.

Papers at this symposium will report on the progress of these four initial consortia.

The Consortium model

The organisation of scientists and research institutions to tackle a common goal requires a model that is open to those who can contribute, mutually beneficial, and exploitative of synergies. The consortium approach used in the SWNM is such a model. Research planning has been undertaken by a group of concerned NARES, NGOs and farmers' organisation, the IARCs playing the role of facilitators in the exercise. A facilitator, a steering committee and an annual assembly are essential to ensure the effective operation of the consortium. NARES play the central role in the consortia, playing the key role in the participatory research, but with a broad responsibility for underpinning applied and strategic research (Fig. 1). Another major attraction of the consortium model is the capacity to draw the interest of AROs, which can contribute significantly through strategic and basic research. In turn the consortium provides a carefully considered development context for their more strategic interests. The whole idea of the programme is to take a bottom up approach with iterative discussions between farmers, NARES, IARCs and AROs in research planning and in the implementation of the research process.

Figure 1. The primary stakeholder domains across the research continuum of an SWNM consortium



The Global Programme

Leaders of the four SWNMP consortia co-ordinate the research through a global steering committee co-convened by CIAT and IBSRAM. The committee is charged with harmonising activities across the consortia, evaluating progress, reporting to a donor support group, identifying common training and information programmes, and designing focal points for cross cutting initiatives and working groups. To date, the main area focus of the global programme is on putting in place research activities in the four consortia, after careful discussions on the methodologies to be used. The aim is to obtain rapid results on the socio-economic background of some of these major land degradation processes. Biophysical, socio-economic and policy research efforts developed through dialogue with farmers and rural communities will lead to long lasting land management solutions to these problems.

Cross cutting research is being pursued by SWNMP participants to enhance the efficiency of the global effort. An example of cross cutting research is the area of resource management domains (RMDs). A workshop on RMDs in 1996 drew together many of the IARCs from the SWNM programme to discuss collaboration in refining the RMD concept (IBSRAM 1998). This research is providing a link between the global SWNM programme and the ecoregional programmes of the CGIAR. Global SWNM research in progress involves collaborative testing of decision support systems and a series of workshops to evaluate and develop methods for impact assessment. A recent workshop in Bogor, Indonesia reviewed the causes and impacts of soil erosion at multiple scales. The meeting involved key researchers from current and potential members of the SWNMP consortia, and reviewed the latest thinking on soil erosion research methods from a wide range of disciplines. Future workshops will review knowledge on the impacts of nutrient depletion.

Methodology development and sharing has proven to be the glue that holds the consortia together and justifies the international effort to harmonise the research globally. It also provides a rationale for further expansion of the SWNMP in the future. The fuel for such research is driven by the demand for increased food production to cope with population pressure and for a cleaner and a safer environment as exemplified by the results of the recent Kyoto conference on global warming.

References

- DUMANSKI, J. and CRASWELL, E.T. 1998. Resource management domains for evaluation and management of agro-ecological systems. In: *Resource Management Domains*, ed. J.K. Syers and J. Bouma. Bangkok: IBSRAM.
- FISCHER, G., and HEILIG, G.K. 1997. Population demand and the demand on land and water resources. *Phil. Trans. R. Soc. Lond. B.* 352, 869-888
- GREENLAND, D.J., BOWEN, G., ESWARAN, H., RHOADES, R., and VALENTIN, C. 1994. Soil, Water, and Nutrient Management Research - A New Agenda. IBSRAM position paper. IBSRAM, Bangkok.
- IBSRAM. 1998. *Resource Management Domains*, ed. J.K. Syers and J. Bouma. Bangkok: IBSRAM.
- IBSRAM/DSE (International Board for Soil Research and Management/Deutsche Stiftung fuer Internationale Entwicklung) 1995. The Zschortau Plan for the Implementation of Soil, Water, and Nutrient Management Research. Food and Agricultural Development Centre, Feldafing and Zschortau.
- IRRI. 1979. *Priorities for Alleviating Soil-related Constraints to food Production in the Tropics*. Los Banõs: IRRI.
- LATHAM, L. 1998. Using the resource management domains concept in the soil, water, and nutrient management initiative. In: *Resource Management Domains*, ed. J.K. Syers and J. Bouma. Bangkok: IBSRAM.
- OLDEMAN, L.R., KAKKELING, R.T.A., and SOMBROEK, E.G. 1990. *World map of the status of human-induced soil degradation: an explanatory note*: Wageningen, Netherlands and Nairobi, Kenya: ISRIC.
- PINSTRUP-ANDERSON, P., PANDYA-LORCH, R., and ROSEGRANT, M. 1997. *The World Food Situation: Recent Developments, Emerging Issues, and Long-term Prospects*. (ICW/97/09). Consultative Group on International Agricultural Research, Washington, D.C.
- SCHERR, S.J., and YADAV, S. 1996. *Land degradation in the developing world: Implications for food, agriculture and the environment in 2020*. Food, Agriculture and the Environment Discussion Paper 14, International Food Policy Research Institute, Washington, D.C.
- SMYTH, A.J. and DUMANSKI, J. 1993. *FESLM: An International Framework for Evaluating Sustainable Land Management*. World Soil Resources Report No. 73. FAO, Rome.
- TAC (Technical Advisory Committee) 1996. *Priorities and Strategies for Soil and Water Aspects of Natural Resources Management Research in the CGIAR* (SDR/TAC:IAR/96/2.1) TAC Secretariat, FAO, Rome.

Keywords : inter-disciplinary, participatory, land degradation, catchment approach

Mots clés : interdisciplinarité, participation, dégradation des terres, approche bassin versant