

**TRAINING WORKSHOP ON MONITORING NUTRIENT
FLOWS AND EVALUATING FARM ECONOMIC
PERFORMANCE IN TROPICAL FARMING SYSTEMS
(NUTMON)**



**An African Soil Biology and Fertility Network (AfNet) Training
Workshop held in Nairobi, Kenya (14th April – 25th April, 2003)**

Background and introduction

Soil fertility is a dynamic phenomenon. Whereas different parts of North America and Western Europe face surpluses of nutrients and related pollution problems, large parts of the tropical continents see their soil fertility gradually go down the drain. Moreover, many tropical soils are very old, developed on rocks that are more than 200 million years of age. Such soils have been depleted of many nutrients by the natural processes of weathering and leaching. Unfortunately, soil fertility decline generally does not get the same public attention as droughts, flash floods, locust invasions, and the near-extinction of specific endangered animal species. This is caused by the fact that it is a gradual process, not associated with catastrophes or mass starvation, and is largely invisible. Moreover, it is hard to precisely quantify rates of soil fertility decline, as many processes are involved, sometimes interdependent, and often not easy to quantify on a routine basis.

Achieving transition to a competitive, high-value and ecologically sound agriculture typically requires bringing together many elements that farmers manage as decision makers. These elements typically include: better understanding of farmers options for integrated soil management, access to high yielding germplasm, identification of market opportunities and the entrepreneurial skills to exploit them. Monitoring nutrient flows in a farm provides such an opportunity where the physical production resources are assessed and monitored on a periodic basis to establish the nutrient status of the farmers production units. An evaluation of the nutrient flows in a farm unit after an elaborate inventory and monitoring of the flows returns a positive or negative nutrient balance of the farm. Positive nutrient balances in specific production units indicate a healthy state of the production unit while negative balances indicate a depleted state requiring management attention. Understanding nutrient balances in a farm or in its field-plots (production units) creates knowledge therefore that dictates management options available to the farmer or requiring scientific intervention. The concept of nutrient flows is depicted in Figure 1. The interaction of nutrient balances, yield response experiments and their role in sustainable farming options in African farming systems is shown in Figure 2.

In order to build capacity for AfNet members, AfNet scientists in different countries of Africa including, Burkina Faso, Senegal, Mali, Ghana, Nigeria, and Kenya were invited for a two weeks workshop in Nairobi to expose them to a nutrient monitoring methodology developed by Wageningen University and Research Centre in The Netherlands. List of the resource persons and the participants are included as appendices to this report.

THE NUTMON CONCEPT

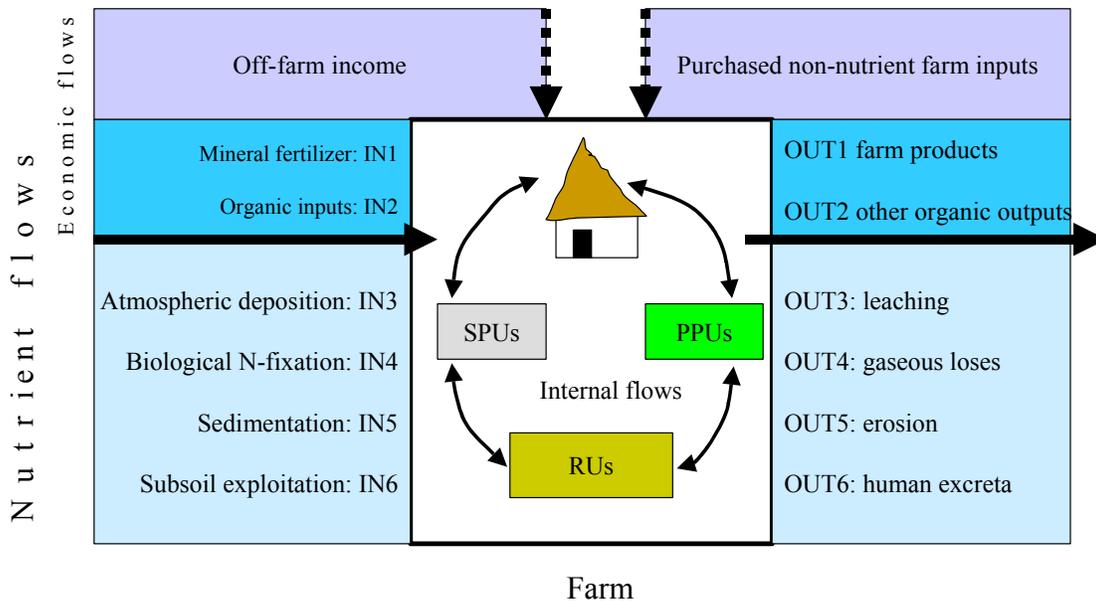


Figure 1. An illustration of the NUTMON Concept

Workshop goal

The workshop goal was to develop the capacity of The African Network for Soil Biology and Fertility (AfNet) member scientists understand on-farm nutrient monitoring methodologies as the basis of determining farm nutrient budgets and balances.

Objectives

- (1) To sensitise and familiarise AfNet Scientists on the concepts and practise of nutrient monitoring.
- (2) To enhance the capacity of the AfNet scientists carry out on-farm participatory research with the farmer on nutrient flows and monitoring, farm level observations, nutrient data entry and nutrient data interpretation as the basis for suggesting nutrient management options available to the farmer.
- (3) To strengthen on-farm research orientation among the AfNet scientists using NUTMON as a tool for better understanding of the farmer's production environment as the means of increasing farm productivity and rural food production.

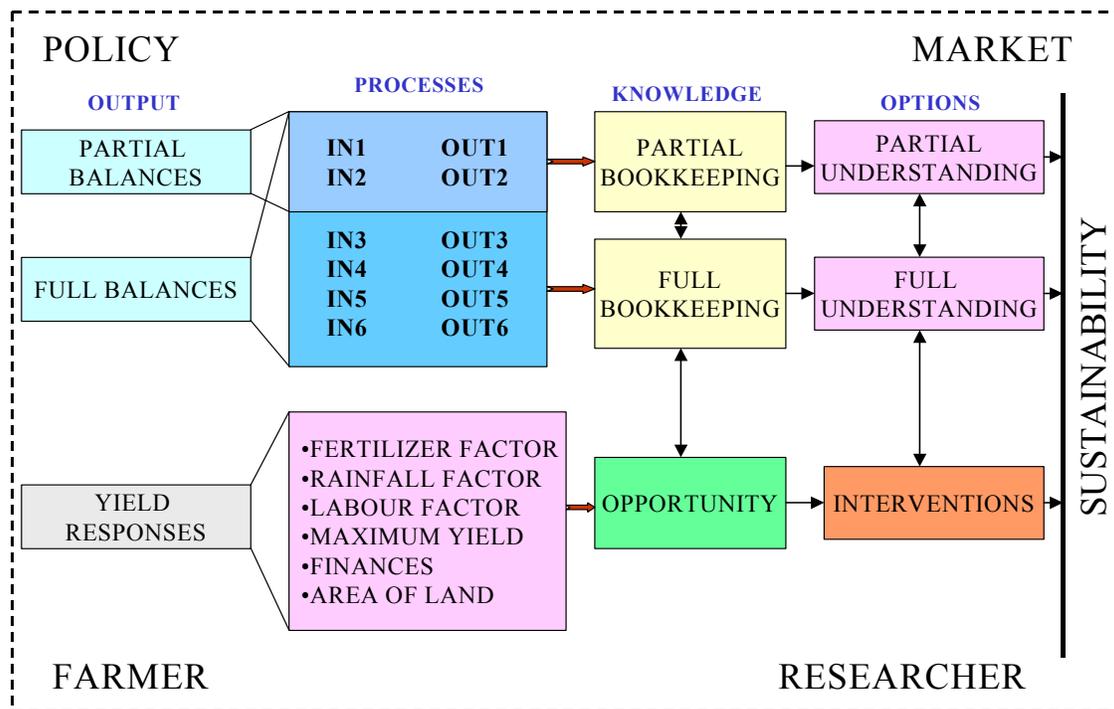


Figure 2. The conceptual framework of NUTMON versus the research, policy, market and farming environment

Topics covered during the workshop

The major subject areas covered during the workshop were:

- (a) Nutrient flow concepts
- (b) Farm-level (micro-level) nutrient flows
- (c) Farm schematisation
- (d) Biophysical and socio-economic farm inventory
- (e) Farm inventory and monitoring scheme
- (f) Data collection in a selected sample of farms
- (g) Digital data entry of farm inventory, nutrient flows, manipulation, processing, debugging and interpretation
- (h) Resource flow mapping and in NUANCES and the role of soil fertility status and maximization of yields
- (i) Definition and determination of farmer typologies
- (j) Economic terminologies and their relevance in farming systems and nutrient monitoring studies

Details of the workshop programme are included as an appendix to this report.

Learning techniques

Learning techniques used during the course included: plenary sessions, individual and group exercises, individual and group presentations, field visits and computer data entry, analysis and interpretation. The duration of the course were fourteen days. Five days were initially spent in plenary sessions to introduce the participants to the concepts of nutrient monitoring, farm typologies, and intervention options for obtaining best returns on farming activities when faced with diverse financial, rainfall, labour and production requirements. Thereafter, 2 days were spent in the field in Embu District collecting on-farm data from six farms. Data entry into the NUTMON software followed this with participants entering the farm data, debugging the data entry and producing nutrient balances and economic reports of one sample farm.

Hired equipment

In order to conduct the computer data entry 10 computers were hired one mounted with a CD writer and a Zip drive for data transfer.

Expected performance of the participants

After the training course, the were able to:

- (a) Carry out nutrient monitoring studies on any desired farm;
- (b) Make an inventory of the farm resources;
- (c) Make an inventory of the biophysical components of the farm production units;
- (d) Monitor nutrient and economic flows in the farm;
- (e) Make an inventory of the socio-economic attributes of the farm;
- (f) Enter farm data into the NUTMON software;
- (g) Debug the entered farm data;
- (h) Export NUTMON data into external databases and spreadsheets for further analysis and presentation;
- (i) Compute nutrient balances and suggest appropriate nutrient management options;
- (j) Recommend economic options and the farmers contribution to the market;
- (k) Recommend policy options for enhancing farm productivity;
- (l) Recommend yield enhancement options; and
- (m) Categorise farm typologies after making several farm inventories.

Expected outputs

The following points are viewed to be the major outputs from the training exercise.

- (a) There will be better understanding of farm nutrient budgets, economic flows, production units, biophysical production environments, resource access, by AfNet Scientists who will thereby assist the poor farmers at other sites and localities to understand and apply farm nutrients judiciously to their farm production units in order to enhance their productivity and sustainability.

- (b) There will be more awareness created on nutrient status of the pilot sites and farms.
- (c) Limitations for optimising nutrient management will be identified and appropriate intervention actions and policies suggested or taken.

Course evaluation

After the completion of the workshop, a standard evaluation of the course was conducted for the participants. Twenty evaluation forms were circulated and thirteen returned after filling. The following is an outcome of the evaluations from the received correspondents. The overall reaction is that the course was very good to excellent. Some of the evaluated topics are included in Table 1 for elaboration. A general comment by all the respondents was that the field data collection and data entry was allocated shorter time than is required for such an exercise. All the participants except one agreed that the workshop met its objectives that corresponded with their own expectations. All the participants also rated the interaction amongst themselves and the resource persons as excellent. The participants asserted that the workshop strengthened their future scientific work in farm nutrient analysis, resource mapping and economic analysis that provided them with opportunities for agricultural productivity enhancement in their own countries and work areas.

Table 1. Participants responses to the training workshop

Rated items	Majority rating	Respondents
Science seminars and concepts	Very good	
Guidelines for strengthening the scientists future work	Appropriate to very appropriate and effective	13
Updating the knowledge of participants in nutrient monitoring and management	Appropriate to very appropriate and effective	11
Entering and processing farm data in NUTMON	Appropriate to very appropriate and effective	11
Quality of provided materials	Good to excellent	9
Sufficiency of provided material	Very sufficient	9
Methods of presentation	Very appropriate	9
How effective?	Very effective	8
Participation in the presentations	Great extent	8
Participation in the discussions	Great extent	9
Participation in the work groups	Great extent	12
Secretariat and organisation	Excellent	11
Hotel arrangements	Excellent	8
Overall evaluation	Very good to excellent	11

Appendix 1. Resource persons

The following were the resource persons during the AfNet workshop.

	Name	Title	Country
1.	Ir. Joost Vlaming	Consultant	Netherlands
2.	Dr. Stephen Nandwa	Consultant	Kenya
3.	Prof. Ken Giller	Professor-Wageningen University	Netherlands
4.	Dr. Ed Rowe	Lecturer-Wageningen University	Netherlands
5.	Dr. Joshua Ramisch	TSBF Socio-economist	Kenya
6.	Mr. Patrick Mutuo	Soil Scientist-ICRAF	Kenya
7.	Mr. Loius Gachmimbi	Soil Chemist - KARI	Kenya
8.	Ms. Fredah Maina	Socio-economist - KARI	Kenya
9.	Mr. Peter Kibe	GIS scientist - KARI	Kenya
10.	Mr. Gitonga Thurania	Statistician & data handler - KARI	Kenya
11.	Dr. Paul Woomer	Soil Scientist-SACRED Africa	Kenya
12.	Dr. Peter Okoth	Lead resource person & workshop coordinator	Kenya
13.	Dr. Bernard Vanlauwe	TSBF Soil Scientist-RFM coordinator	Kenya
14.	Dr. Andre Bationo	TSBF Soil Scientist-AfNet Coordinator	Kenya
15.	Dr. Nteranya Sanginga	Director, TSBF	Kenya

Appendix 2. Participants in the AfNet NUTMON Workshop

	Name	Institution	Country
1.	Adamou Abdou	ICRISAT	Niger
2.	Assefa Abegaz	RESPONSE	Ethiopia
3.	Vincent Bado	INERA	Burkina Faso
4.	Andre Bationo	TSBF	Burkina Faso
5.	Madiama Cisse	ISRA	Senegal
6.	Catherine Gachengo	TSBF	Kenya
7.	Mohamadou Gandah	INRAN	Niger
8.	Christine Kariuki	PhD Student	Kenya
9.	Bocary Kaya	ICRAF	Mali
10.	Job Kihara	TSBF	Kenya
11.	Joseph Kimetu	TSBF	Kenya
12.	Jacinta Kimiti	KEFRI	Kenya
13.	Joseph Miriti	KARI	Kenya
14.	Monicah Mucheru	Kenyatta Univ.	Kenya
15.	Daniel Mugendi	Kenyatta Univ.	Kenya
16.	Anne Muriuki	KARI	Kenya
17.	Patrick Mutuo	ICRAF	Kenya
18.	Chike Nwoke	IITA	Nigeria
19.	Dickens Nyagol	ICIPE	Kenya
20.	Badiori Quattara	CORAF	Burkina Faso
21.	Kristina Roing	IITA	Sweden
22.	Mariana Rufino	RESPONSE	Netherlands
23.	Girmay Tesfay	RESPONSE	Ethiopia
24.	Edward Yeboah	SRI	Ghana

Appendix 3. Workshop Programme

NUTRIENT MONITORING AND NUTRIENT BALANCES TRAINING WORKSHOP

April 22nd –April, 26th, 2003

PROGRAMME

Day 1, Monday April 14th

INTRODUCTION

- 09:00-09:30: Introduction to the training workshop and an overview of AFNET activities – (Andre Bationo)
- 09:30-10:30: Nutrient Monitoring (NUTMON): Concepts - (Stephen Nandwa)
- 10:30-11:00: Tea Break
- 11:00-12:00: Other flows and micro-level nutrient flows - (Peter Okoth)
- 12:00-12:30: Soil, climate market and nutrient flows – (Peter Okoth)
- 12:30-14:00: Lunch
- 14:00-15:00: Methods of quantifying the flows - (Peter Okoth)
- 15:00-15:30: Other definitions - (Peter Okoth)
- 15:30-16:00: Tea Break
- 16:00-17:00: Nutrient balances - (Peter Okoth)

Day 2, Tuesday April 15th

FARM INVENTORY

- 09:00-09:30: Introduction and farm schematization - (Peter Okoth)
- 09:30-10:30: Inventory questionnaires - (Peter Okoth)
- 10:30-11:00: Tea Break
- 11:00-12:00: Information from the farmer – (Stephen Nandwa)
- 12:00-12:30: Information from additional observations - (Peter Okoth)
- 12:30-14:00: Lunch
- 14:00-15:30: Individual exercise on filling out farm inventory forms (imaginary farms)
- 15:30-16:00: Tea Break
- 16:00-17:00: Feedback and discussions

Day 3, Wednesday April 16th

FARM MONITORING

- 09:00-09:30: Purpose of monitoring, timing, and farm records – (Peter Okoth)
- 09:30-10:30: Monitoring questionnaires - (Peter Okoth)
- 10:30-11:00: Tea Break
- 11:00-12:00: Exercise on filling in a monitoring form (imaginary farm) - (Peter Okoth)
- 12:00-12:30: Feedback and clarifications - (Peter Okoth)
- 12:30-14:00 Lunch
- 14:00-15:00: A water harvesting trial example – (Andre Bationo)
- 15:00-15:30: Measurement of C stocks in terrestrial ecosystems – (Patrick Mutuo)
- 15:30-16:00: Tea Break
- 16:00-17:00: Measurement of C stocks in terrestrial ecosystems... continued with an exercise – (Patrick Mutuo)

Day 4, Thursday April 17th

FIELD WORK PREPARATIONS AND FARM TYPOLOGIES

- 09:00-10:00: Production units and farm sections designation – (Loius Gachimbi)
- 10:00-10:30: Practical exercises with each participant producing an hypothetical farm layout - (Loius Gachimbi)
- 10:30-11:00: Tea Break
- 11:00-12:00: Description of the field work area and farms to be visited
- 12:00-12:30: Field work groups
- 12:30 – 14:00: Lunch
- 14:00 – 15:00: Introduction to NUANCES and role of soil fertility status (Giller)
- 15:00 – 15:30: Determination of farmer typologies (Kruseman/Ramisch)
- 15:30 – 16:00: Tea break
- 16:00 – 18:00: Working groups (4 groups) deliberating on appropriate tools and criteria to rank farmers; discussion for 1hr, reporting back for 40min (10 min per working group); general discussion + wrap-up for 20min.

Day 5, Friday April 18th

- 08:30 – 10:00: Use of farm typologies (Rowe)
- 10:00 – 10:30: Tea break
- 10:30 – 12:00: Use of RFM and farmer typologies – a case study + evaluation and discussion (Giller/Vanlauwe)
- 12:00 – 13:30: Lunch
- 13:30 – 15:30: 4 Working groups on opportunities for interventions in three different farming systems (1 hr discussion, 40min feedback, 20min wrap-up)
- 15:30 – 16:00: Tea break
- 16:00 – 17:30: SWOT analysis – RFM/farm typologies in 3 groups (1 hr discussion, 30min reporting back (10min per group)

17:30 – 18:00: Workshop evaluation - discussion and questionnaire (All)

Day 6, Saturday April 19th

FREE DAY FOR SHOPPING AND INDIVIDUAL TOURS

Day 7, Sunday April 20th

FIELD TRIP

14:00 Participant depart for trip to Embu (Destination, Isaac Walton Hotel)

Day 8 and 9 Monday 21st and Tuesday 22nd of April

FIELD DATA COLLECTION ON SELECTED FARMS

(Peter Okoth and Peter Kimani Kibe)

08:00: Depart from hotel

13:00-14:00 Lunch break

17:00: Return to hotel

Day 9 Tuesday 22nd of April

REPORT ON FIELD DATA COLLECTION ON SELECTED FARMS

(Peter Okoth and Joost Vlaming)

09:00: Depart from hotel

11:30: Arrival at ICRAF

12:00-13:30: Presentation preparations and lunch break

13:30-14:30: Presentation from each group (10 minutes each)

14:30-15:30: Discussions

15:30-15:45: Tea Break

15:45-17:00: Introduction to the NUTMON Software and Data Entry

Day 10, Wednesday April 23rd

DATA ENTRY

09:00-10:30: Data entry-complete farm data (Joost Vlaming, Peter Okoth, Thurania)

10:30-10:45: Tea Break

10:45-12:30 Data entry continued (Joost Vlaming, Peter Okoth, Thurania)

12:30-14:00 Lunch

14:00-15:30: Data entry continued (Joost Vlaming, Peter Okoth, Thurania)

15:30-16:00: Tea Break

16:00-18:00: Data entry continued (Joost Vlaming, Peter Okoth, Thurania)

Day 11, Thursday April 24th

DATA ENTRY

- 09:00-10:30: Data entry continued (Joost Vlaming, Gitonga Thurania, Peter Okoth)
- 10:30-10:45: Tea Break
- 10:45-12:30: Data debugging (Joost Vlaming, Gitonga Thurania, Fredah Maina)
- 12:30-14:00: Lunch
- 14:00-14:20: Talk by Director of TSBF (Dr. Nteranya Sanginga)
- 14:20-15:00: Talk on Soil Organic Matter (Dr. Paul Woome)
- 15:00-15:30: Carbon stocks measurement in the field (Patrick Mutuo)
- 15:30-16:00: Tea Break
- 16:00-17:00: Economic Indicators in NUTMON (Fredah Maina)
- 17:00-18:00: Data processing (Joost Vlaming, Fredah Maina, Gitonga Thurania)

Day 12, Friday April 25th

DATA PROCESSING AND RECOMMENDATIONS

- 09:00-10:30: Data processing continued (Joost Vlaming, Fredah Maina, Gitonga Thurania)
- 10:30-11:00: Tea Break
- 11:00-12:30: Interpretation of NUTMON results - (Peter Okoth, Joost Vlaming)
- 12:30-14:00 Lunch
- 14:00-15:00: Applications of NUTMON – (Stephen Nandwa)
- 15:00-15:45: Data consistency in NUTMON – (Louis Gachimbi)
- 15:45-16:00: Tea Break
- 16:00-16:30: Workshop evaluation - (Peter Okoth)
- 16:30-17:00: Way forward and concluding remarks – (Andre Bationo)

Day 13, Saturday April 26th

Departure of workshop participants

(Please make sure you confirm your return flights with Juliet at the earliest opportunity on Telephone 524755 or during workshop registration)