



Food and Agriculture
Organization of the
United Nations

Burkina Faso

Malawi

Bangladesh

Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia

Soils4nutrition

Thanks to the financial support of



Federal Ministry
of Food
and Agriculture



Micronutrient deficiencies: The hidden hunger

- 40 % of global cultivated land is zinc deficient
- The first cause for malnutrition is soil deficiency, followed by low food intake.
- Micronutrient deficiencies affect immunity, blindness, stunted development, anemia, diarrheal and respiratory infections.

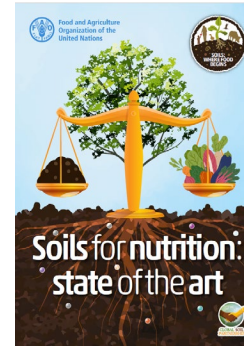


Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia



Main project outputs

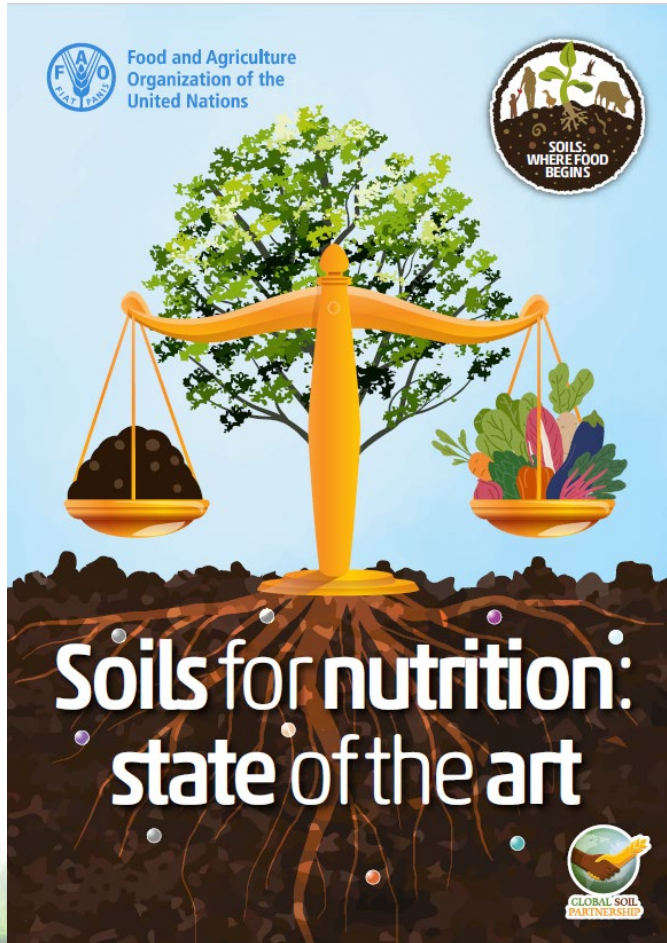
- Soils4Nutrition: state of the art
- Demonstration sites
- National policy briefs
- Technical guidelines
- Farmers training
- Global symposium on Soils4Nutrition



Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia



Soils for nutrition: state of the art



- Available information & Knowledge gaps
 - Status and trends of nutrients needs and efficiency
 - Role of soils on nutrient assimilation
 - Impacts on misuse and overuse on environmental pollution and climate change
- Information to disseminate
 - Enhance soil health
 - Enhance nutritional food value
 - Ensure food safety and inocuity

Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia

SSM practices implemented in field trials

Micronutrient fertilizers



Crop rotation / Pulses



Soil organic matter application



Crop association / Pulses



Effective dissemination of SSM practices

- ✓ Farmers feel valued in their community through the field trials
- ✓ The field trials are a good opportunity to bridge the gap between farmers' needs and government directions




|| Sustainable Soil Management technique will improve soil quality and increase our overall production.... ||



Md. Faruk
Farmer
Chandina, Cumilla

|| Soils are getting weaker day by day. With the guidance and instruction we get from your institution will surely help us restoring the soil health. ||

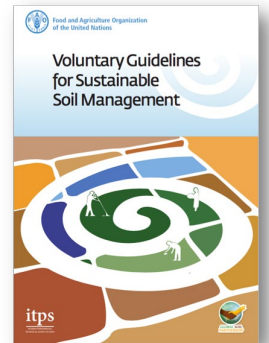


Dilu Mian
Farmer
Chandina, Cumilla

Global Soil Doctors Programme



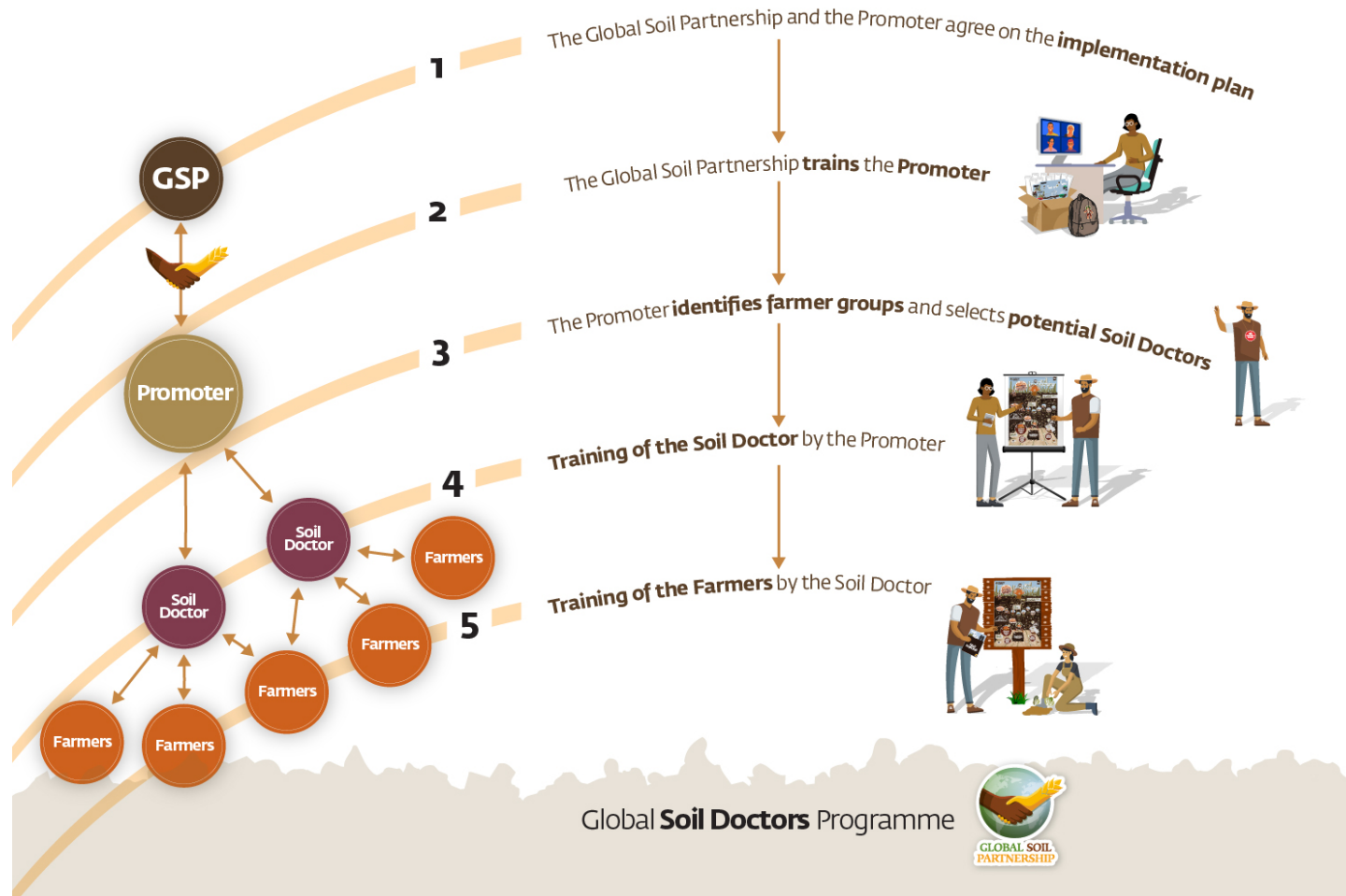
- Farmer to farmer programme
- Build the capacity of farmers on soils and sustainable soil management;
- Provides educational material
- Supporting governmental agencies and organizations working on agricultural extension in the field.



Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia



Global Soil Doctors Programme roadmap



National promoter:



DAE

কৃষি
সম্প্রসারণ
অধিদপ্তর

SRDI

মৃত্তিকা সম্পদ
উন্নয়ন
ইনস্টিটিউট

The national promoter is key:

- Reach the farmers and implement sustainable soil management practices
- Provide efficient support to farmers, updated materials and tools
- Compile national feedback, pictures, videos
- Get international visibility
- Promote experience exchanges

Global Soil Doctors Programme

First pilot implemented at global level

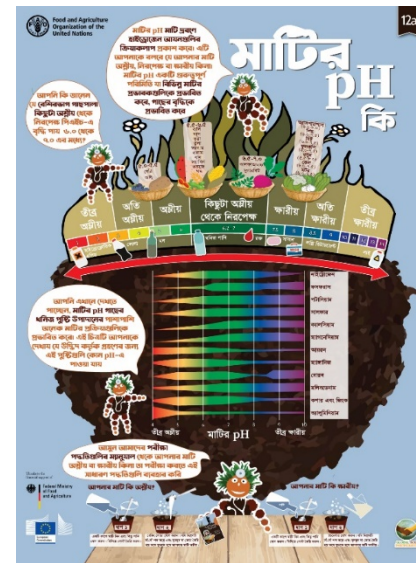
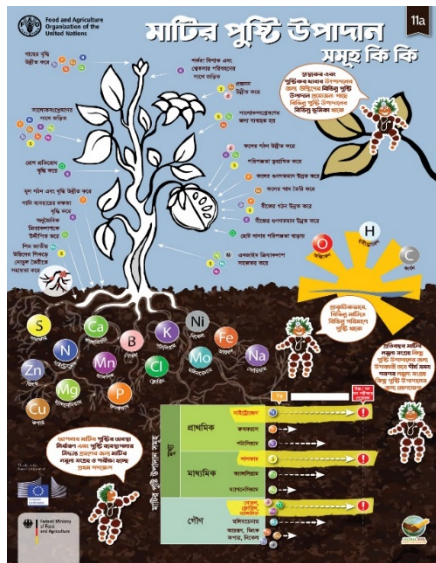
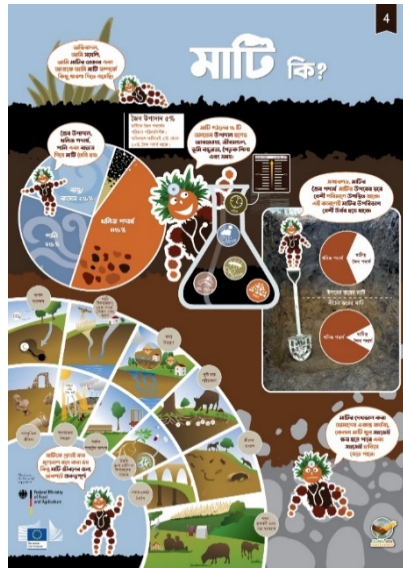
Training module: Soils4Nutrition

Topic	Soil 4 Nutrition
Objective	Emphasize the role of soil nutrients and soil structural components for agricultural production, food security and nutrition. Identify the best soil conditions that optimize plant nutrients uptake
Posters	<p>What is soil? How to enhance soil organic matter? What is soil pH? How to manage soil nutrients?</p> 
Field exercises	<p>Qualitative assessment of soil physical, chemical and biological properties.</p> <p>Soil educational toolkit → </p> <p>Soil pH kit donated by the government of Thailand → </p> 
Evaluation	<p>Final evaluation of soil condition and recommendations on SSM practices</p> 

Step 1: Implementation plan

Training content, translations, agendas, practical exercises, kits, visibility, guidelines

Global Soil Doctors Programme: Posters



Global Soil Doctors Programme

Step 2: Training of 9 trainers

- Voluntary basis,
- Local knowledge,
- Effective dissemination strategies
- Farmers empowerment



Trainers_Ana_Raf.pdf



Trainers_Hum_Kab_Shir.pdf



Trainers_Ibn_Joy.pdf



Trainers_Lut_Rahm.pdf



Trainers_Miz_Rahm.pdf



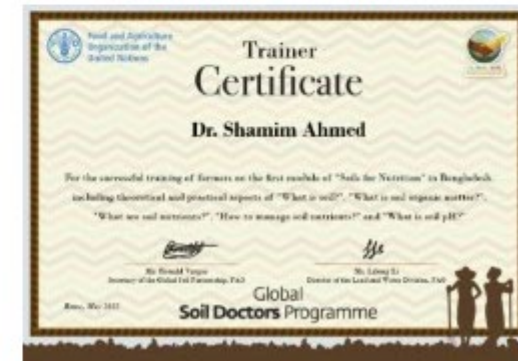
Trainers_Pa_Ka_Bis.pdf



Trainers_Raj_Ahma.pdf



Trainers_Sam_Sin.pdf



Trainers_Sha_Ahm.pdf

Global Soil Doctors Programme

Chief Guest delivered his speech



Briefing of Session Chair



Step 3:
Identification of
farmers groups

Chandina
Chuadanga sadar
Baliadangi Upazila



**The national promoter is
key:**

- Institutional recognition
- Local knowledge

Global Soil Doctors Programme

Step 3: Selection of Soil Doctors by certified trainers



Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia



Global Soil Doctors Programme

Step 4: Training of Soil Doctors

pH determination



Soil sampling



Global Soil Doctors Programme

Step 4: Training of Soil Doctors

Soil texture



Fertilizer identification



Practical Class on Soil
Organic matter



Global Soil Doctors Programme

Step 4: Training of Soil Doctors



Global Soil Doctors Programme



Rozina Akter
Union: Atbarpur



Ayesha Akter
Union: Keronkhal



Md. Tajul Islam
Union: Madhaiya



Astomi Rani Das
Union: Bataghashi



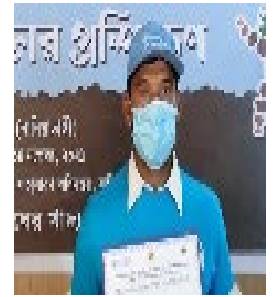
Ariful Islam Liton
Union: Barkarai



Ireen Akther
Union: Gollai



Md. Faruk Bhuiyan
Union: Maijkhari



Md. Nur Alam
Baliadangi,
Thakurgaon



Md. Masum Billah
Union: Barkait



Billal Hossain
Union: Barera



Suma Rani Datta
Union: Mahichal



Md. Saimur Rahman
Union: Suhilpur



Md. Billal Hossain
Talukder
Union: Joyag



Mohibur Rahman
Union: Dollai Nababpur



Md. Abdullah
Chudanga Sadar

First 15 Soil
Doctors in
the World

Sustainable soil management for nutrition-sensitive
agriculture in Sub-Saharan Africa and South East Asia



Conclusions of the Soils4Nutrition Project

Soil knowledge and research

- Soils4Nutrition: state of the art
- Demonstration sites
- Global symposium on Soils4Nutrition



Implementation tools

- National policy briefs



- Technical guidelines



- Soil Doctors programme

Enhance soil health

Enhance nutritional food value

Ensure food safety and inocuity



National Policy briefs

National Policy Brief

Sustainable soil management as keystone of nutrition sensitive agriculture in Bangladesh

Key messages

In Bangladesh, more than half the population suffers from malnutrition. Severe acute malnutrition affects 450,000 children, while close to 2 million children suffering moderate acute malnutrition.

Nutrient deficiencies are due to the majoritarian consumption of nutrient poor staple crops, grown on nutrient depleted soils. In particular, deficiencies of zinc and boron are widespread in Bangladesh.

Intensification of agriculture using nutrient-rich high-yielding varieties can lead to the decline of soil fertility due to mining of nutrients and soil organic matter depletion, thus jeopardizing longer term food security.

Soil health is important for a long term nutrient supply capacity and must be considered in nutrition sensitive agriculture.

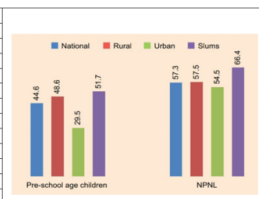
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SSM practices, inclu
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apply balanced mic
well as organic mat

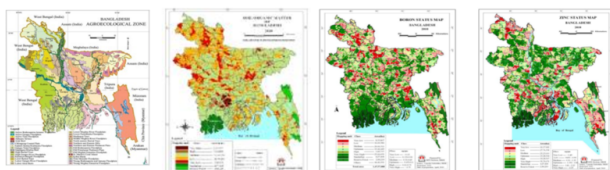
Table 1. Prevalence of Micronutrient and Nutritional Status of Bangladesh (Source: National Micronutrient Survey 2011-2012)

	Rural (%)	Urban (%)	Slum (%)
Subclinical vitamin A deficiency			
Preschool Children	19.4	21.2	38.1
School-age children	20.2	22.1	27.1
NPNL women	5.4	4.9	6.9
Zinc deficiency			
Preschool children	48.6	29.5	51.7
NPNL women	57.5	54.5	66.4
Nutritional status of preschool children			
Stunting	31.4	31.3	51.1
Wasting	21.1	12.9	20.3
Underweight	29.6	28.1	47.4



On the other hand, agricultural intensification has put a tremendous pressure on arable land, mining soil nutrients and producing a decrease of soil organic matter, with the consequent decreased soil fertility, as well as other related degradation processes such as soil erosion, pollution, increased soil salinity, compaction and pan formation, acidification and deforestation, that impair agricultural yields and ultimately decrease the crop nutrient content.

In order to maintain soil production, increasing amounts of chemical fertilizers have been required. The Government has issued a Fertilizer Recommendation Guide (2018) that includes recommendations on the dose and time of application of fertilizers based on AEZ, and including macro and micronutrients.



Healthy crop soils: the gear for better nutrition in Malawi

The first results of the field trials showed that crops produced under low soil fertility conditions are lowly productive and that improving soil nutritional status through fertilization has a positive effect in yields. The yield increases are higher in the case of organic additions compared to mineral fertilizers (figure 1). The calculated land equivalent ratio also supports this observation.

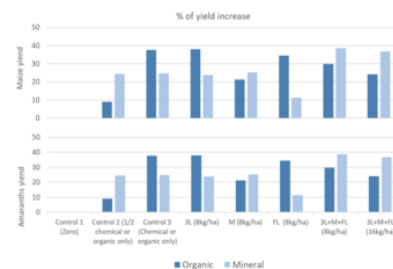


Figure 1

The improvements in soil health, however, could not be quantified through these field essays, since the duration of the trials (1 year) is too short for the detection of trends in slow-changing variables, such as SOM content. In fact, organic manure and maize-legume intercropping may take more than two-three seasons to build soil organic matter. These delayed benefits of the technologies applied must be thus tracked, communicated and considered in policy design, as otherwise the risk of dis-adoption of the technologies after one or two seasons of use may increase (Jew et al 2020).

The right rate, time, place, and source for micronutrient fertilizers

Foliar application of micronutrients to crops showed also notable increases in maize, soybean and amaranth yield (figure 1), and in nutrient content in edible parts of crops (figure 2).

The effect was higher in intercropping than in mono-cropping systems, and when multi micronutrient dressing was applied compared with single element foliar contributions. For example, around a 20-25 % increase yield was obtained with the separate foliar application of Cu and Zn to maize (figure 3), compared to almost 40% increase when multi micronutrient dressing was applied in the intercropping trial together with organic soil additions.

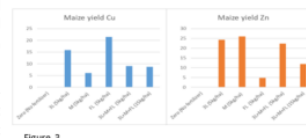


Figure 3

Recommendations and way forward

The evaluation trials have shown that use of integrated fertility management including intercropping, organic and mineral fertilizer additions to the soil, and application of foliar multi micronutrient dressings

Document d'orientation

La gestion durable des sols comme clé de voûte de l'agriculture sensible à la nutrition au Burkina Faso

Messages clés :

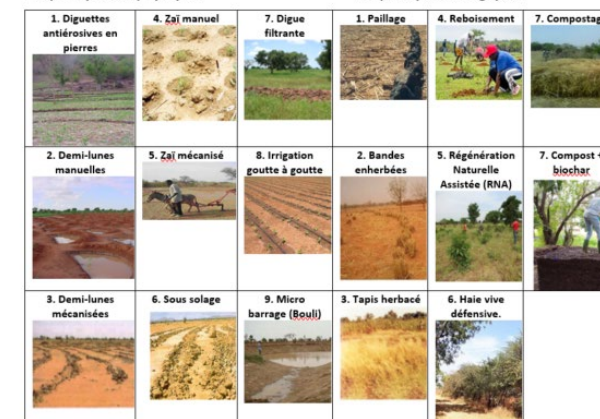
- *Données sur la nutrition dans le pays* : au Burkina Faso, malgré les importants efforts déployés, l'évolution de la malnutrition aiguë, de l'insuffisance pondérale et de la malnutrition chronique est demeurée très faiblement décroissante de 2009 à 2021.

- *Productivité des cultures dans le pays* : au regard de l'état de dégradation avancée des terres et du niveau relativement faible des interventions sur les sols, la productivité des cultures reste encore assez faible.

L'Institut de l'Environnement et de Recherches Agricoles (INERA) a répertorié un total non exhaustif de bonnes pratiques dont certaines pratiques biophysiques et d'autres biologiques (BAMBARA, 2022).

Les pratiques biophysiques

Les pratiques biologiques



Des sols agricoles sains : le puits d'une meilleure nutrition

Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia

Technical guidelines



Federal Ministry
of Food
and Agriculture

Case studies

Key messages and recommendations

Technical Guidelines on Soils4Nutrition

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Soils4Nutrition: a project to tackle soil and crop nutrient deficiencies

Through the project on "Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia", the Global Soil Partnership supports FAO member countries to apply sustainable soil management practices, in an effort to improve the nutritional quality of locally-produced food to address human micronutrient deficiencies. The project was set up with funding from Germany's Federal Ministry of Food and Agriculture (BMEL) in Bangladesh, Burkina Faso and Malawi where governments highlighted the need to address human nutrient deficiencies, particularly in poor rural communities. The three main outcomes of the project included a review of existing knowledge, demonstration of best management practices, and country-specific and global soil management recommendations to combat crop nutrient deficiencies.



Figure 2. Demonstration site in rotation of rice-cowpea/soy and mungbean in the Baidyanganj district (Bangladesh). <https://www.flickr.com/photos/soil4nutrition/50288633807/in/album-72157713788924677/>

The results of the field trials indicate that by following the basic principles of sustainable nutrition management, farmers can produce higher quality food and transform their diets. The field trials provided important information on the right time, the right form and the right place to apply micronutrient fertilizers, along with the benefits of associated micronutrients use with sustainable soil management practices. Also, given the low level of knowledge rural actors on the role of soils, the project focuses much of its efforts on training farmers and extension services at each of the demonstration sites.

Figure caption

Capacity building focused on practical soil knowledge mechanisms through the application of the global S4N initiative. This program also provides the establishment sustainability of the actions undertaken.

A thorough review of the existing literature showed that there is a need for more knowledge on the mechanisms of soil health and its impact on crop productivity.

Stakeholder consultation in Burkina Faso

In Burkina Faso, malnutrition continues to increase, despite the government's efforts to diversify diets and fortify foods. In fact, 92% of children aged 6 to 59 months have nutritional anaemia, 13% of which is severe. This situation is also of concern among pregnant women and nursing mothers, with prevalence rates of 68.3% and 52.5% respectively (INSD and ORC Macro, 2004). Data on other micronutrients such as zinc or copper are scarce, but estimates suggest that those deficiencies are also very high. These are based in a large part on the rate of soil degradation in Burkina Faso, which reaches 65% of the national territory, according to BUNASOLS, the national soil survey office.

During a national workshop held in Burkina Faso in April 2022 in the framework of the Soils4Nutrition project, the suitability of the most known and commonly used SSM practices regarding the country social and economic context was evaluated. Participants included forty-one national experts from national and local institutions, NGOs and private sector. The active participation and fruitful discussions allowed to identify actions to prioritize in the country for an improvement of the micronutrient content of locally produced food:



Figure 5. M. Traore Mamadou, Director General of BUNASOLS in the national workshop in Burkina Faso.

Among the management options considered in the workshop, some practices widely known to be beneficial for soils, such as green manures and cover crops, were discarded as priorities because of cultural aspects that prevent farmers from appropriating them.

It became clear that soil health is not understood as a priority by itself and allocating resources to its improvement, instead of obtaining products to be sold or consumed, is not considered to be advantageous. The key role of soil for improving the nutritional value of food needs to be further communicated.

In conclusion, efforts in sustainable soil management for nutrition-sensitive agriculture in Burkina Faso must be multiplied. These efforts should be directed primarily to the most promising sectors and practices in order to achieve an effective scaling up of results.

- The rational use of organic and mineral fertilizers in combination with micronutrients must be developed in the country. The main barrier identified for its application is the lack of availability of specific fertilizers. The solution envisaged is to share the results obtained by the project with the agro-dealers and request products with the adequate characteristics.
- The elaboration of on-farm compost from organic residues needs to be promoted. This seems to be the most suitable solution to increase the organic matter of the soils of small producers who can easily access wastes from fallow lands or harvest residues. Appropriate technical support is needed for achieving wide adoption.
- Agroecology, which already has solid experience in the country, must be further developed and promoted. Agroecology implements the combination of agrodiversity and the use of natural products, which is very favorable to the health of the soil and to an integral management of fertility.
- Practices of soil conservation and erosion control must continue to be promoted and disclosed.

1 Aim for soil health and monitor soil change

Key messages:

Soil characteristics have to be assessed before interventions are designed
Soil organic matter increases soil health through the improvement of its physical, chemical and biological properties, including a higher capacity for storing nutrients.
An adequate pH ensures that the nutrients present in soils are readily available to crops.
Soil physical and biological characteristics are crucial for avoiding nutrient losses.
It is necessary to monitor soil health in order to ensure an adequate nutrient balance through fertilization, and to enable the choice of the most suited management practices.

By being more informed about the current state of the soil, we can plan for future use and ensure the most beneficial outcomes.

Promote crop diversification

Key messages:

Crop diversification can improve soil health and nutrient balance.
An adequate use of diversification strategies, in particular including legumes, can improve yields while diminishes the need of external inputs.
Using crop-diversified systems has proved to increase the nutrient content in crops.
Crop diversification has demonstrated to be a cost-effective management system.
Crop diversification, reflected in the diversification of diets, further enhances the nutritional benefit obtained.

Key messages:

Farmer-to-farmer extension can be a good complement to formal extension services for building capacities on soils, SSM, and combating micronutrient deficiencies.
Capacity based approaches to extension are capable of reaching larger populations.
Adoption of SSM can be widened and disadoption reduced if the benefits of the S4N approach are conveniently communicated.

One of the barriers consistently observed for a wide adoption of the NSA approach is the lack or scarcity of grassroots knowledge on the links between soil health and nutrition. Although farmers are normally aware that soils are important for obtaining abundant crops and use fertilizers for improving yields, the effects of soil management on the nutritional value of foods are not that obvious, and soil health generally is not understood as a desirable outcome of agricultural management.

The facilitation of training to farmers' and building capacities among the rural population in these subjects is of paramount importance, and governments must strengthen the knowledge and capacities of their extension services to that end.

Sustainable soil management for nutrition-sensitive agriculture in Sub-Saharan Africa and South East Asia





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