



Global Theme on Agroecosystems

Report no. 23

Fertilizer Micro-Dosing for the Prosperity of Small-Scale Farmers in the Sahel

Final Report



International Crops Research Institute for the Semi-Arid Tropics

Citation: Tabo R, Bationo A, Diallo Maimouna K, Hassane O and Koala S. 2006. Fertilizer micro-dosing for the prosperity of small-scale farmers in the Sahel: Final report. Global Theme on Agroecosystems Report no. 23. PO Box 12404, Niamey, Niger: International Crops Research Institute for the Semi-Arid Tropics. 28 pp.

Abstract

This project which is funded by USAID was conducted in three countries of West Africa, namely Burkina Faso, Mali and Niger, between June 2002 and December 2004. The goal of the project was to increase crop production and farmer incomes through the uptake of fertilizer micro-dosing technology and better farmer-based cooperative organizations. The project activities were implemented using a participatory approach through a network of partners from the National Agricultural Research and Extension Systems (NARES), Non-Governmental Organizations (NGOs), farmers and farmers groups and other International Agricultural Research Centers. These activities consisted of demonstration and on-farm trials of the fertilizer micro-dosing technology, Farmers Field Schools (FFS), training of farmers and technicians, training workshops, strengthening of farmers associations in “warrantage” or inventory credit system and exchange visits between farmers from the three project member countries. This report highlights the major achievements of the project. In all the three participating countries, over the two years of the study, yields of sorghum and millet increased by 44 to 120% while income of farmers increased by 52 to 134% when using the fertilizer micro-dosing and the “warrantage” (inventory credit system) than with the earlier recommended and farmer traditional practices. Farmer access to credit and inputs was improved substantially through the “warrantage” system. The technology has reached up to 12,650 farm households in the three countries and efforts are in progress to further scale-up and out the technology to wider areas.

This work is a part of the project funded by the United States Agency for International Development (USAID). The authors record their appreciation for the significant and sustained support from USAID and for the dedication and collaborative support of all the partners from the national agricultural research and extension systems (NARES), the non-governmental organizations (NGOs), other international agricultural research centers (IARCs) and the farmers in the Sahel.

The views expressed are those of the authors and not necessarily those of ICRISAT. The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of ICRISAT concerning the legal status of any country, city, territory or area, or its authorities, or concerning the delimitation of its frontiers or boundaries. Where trade names are used, this does not constitute endorsement of or discrimination against any product by the Institute.

**Global Theme on Agroecosystems
Report no. 23**

**Fertilizer Micro-Dosing for the Prosperity
of Small-Scale Farmers in the Sahel**

Final Report

June 2002 – December 2004

Submitted to the United States Agency for International Development

R Tabo, A Bationo, K Diallo Maimouna, O Hassane and S Koala



ICRISAT

International Crops Research Institute for the Semi-Arid Tropics

2006

Acknowledgments

The USAID TARGET Project expresses its sincere gratitude to the many individuals and institutions that have contributed their time and expertise to this project. We would like to acknowledge the cooperation and assistance from the following individuals and institutions during the past two years:

- Our farmer partners and farmer organizations for their contribution in the realization of demonstrations, infrastructures, training and diffusion of information related to the technologies.
- Our partners in Burkina Faso: Institut de l'Environnement et de Recherches Agricoles du Burkina Faso (INERA), Association pour le Développement de la Région de Kaya (ADRK), Fédération Nationale des Groupements Naam (FNGN), and Hunger Project.
- Our partners in Mali: Institut d'Economie Rurale (IER), Association pour le Développement des Activités de Production et de Formation (ADAF/Galle), Sasakawa Global 2000 (SG 2000), and Winrock International.
- Our partners in Niger: Institut National de Recherche Agronomique du Niger (INRAN), Projet Intrants FAO, and various Non-Governmental Organizations (NGOs).
- Our financial partners: Système de Financement Décentralisé (SFD) and local commercial banks for providing credit for the warrantage credit systems.
- The International Fertilizer Development Center (IFDC) and the Tropical Soils Biology and Fertility Institute of CIAT (TSBF-CIAT) for their collaboration.
- All the scientists from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the participating National Agricultural Research and Extension Systems (NARES) who contributed in one way or another to the implementation and success of the project.
- The United States Agency for International Development (USAID) for their financial support to the project.

Contents

Acronyms and Abbreviations	iv
Executive Summary	1
1. Introduction	2
1.1 Context	2
1.2 Objectives	2
2. Approach and Methods	2
2.1 Selection of project study sites	3
2.2 Setting up of demonstration plots	3
2.3 Establishment of farmer organizations and the warrantage credit system	4
2.4 Establishment of farmer field schools (FFS)	5
2.5 Capacity building	5
2.6 Collection and analysis of agronomic and socio-economic data	5
3. Results and Achievements	6
3.1 Raising soil fertility	6
3.2 Improving farmers' access to credit and inputs through the warrantage credit system	10
3.3 Capacity building	13
4. Conclusions and Future Perspectives	16
Annexes	19

Acronyms and Abbreviations

ADAF/Galle:	Association pour le Développement des Activités de production et de Formation
ADRK:	Association pour le Développement de la Région de Kaya
AGR:	Activités Génératrices de Revenus
DAP:	Di-Ammonium Phosphate
FAO:	Food and Agricultural Organization
FNGN:	Fédération Nationale des Groupements Naam
ICRISAT:	International Crops Research Institute for the Semi-Arid Tropics
IER:	Institut d'Economie Rurale
IFDC:	International Fertilizer Development Center
INERA:	Institut de l'Environnement et de Recherches Agricoles du Burkina Faso
INRAN:	Institut National de Recherche Agronomique du Niger
NPK:	Nitrogen, Phosphorus and Potassium
NGO:	Non-Governmental Organization
PO:	Producers Organization
SG2000:	Sasakawa Global 2000
SFD:	Système de Financement Décentralisé
TSBF-CIAT:	Tropical Soils Biology and Fertility Institute of CIAT
USAID:	United State Agency for International Development

Executive Summary

This report describes the activities undertaken by the USAID TARGET project in Burkina Faso, Mali, and Niger between June 2002 and December 2004. Some of the key achievements of the project are as follows:

- ❖ Evaluation and diffusion of the fertilizer micro-dosing technology
 1. Results of the demonstration trials showed that sorghum and millet yields were 44 to 120% higher when using the fertilizer micro-dosing than with the earlier recommended dosage and farmers' practices.
 2. Income of farmers using fertilizer micro-dosing and inventory credit system (warrantage) increased by 52 to 134%.
 3. The fertilizer micro-dosing technology reached up to 12,650 farm households in the three countries (Burkina Faso, Mali and Niger) during the two-year period of the project.
 4. Field technicians and farmers were trained to apply fertilizer by micro-dosing demonstration trials and to perform socio-economic surveys.
 5. Participatory evaluations of the technology were performed.
 6. Public awareness was heightened through the media.
- ❖ Enhancement of farmers' production through the warrantage credit system.
 1. Partners (farmers and NGOs) were trained on the concept of warrantage.
 2. The warrantage system was introduced in Burkina Faso and reinforced in Mali and Niger.
 3. Organizational capacities of farmer organizations were strengthened.
 4. Farmer incomes increased and income-generating activities were promoted.
 5. Farmer organizations were assisted to build and/or to equip their stores to conduct warrantage activities.
- ❖ Training of producers on the micro-dose technology using the farmer field schools (FFS).
 1. Farmer interns were trained on various agricultural themes using the FFS approach.
 2. Farmer field days were organized at the sites of the farmer field schools to promote the technology.
 3. The micro-dose technology and the warrantage credit system were extended in neighboring villages through farmer field schools and farmer field days.
 4. Project activities were promoted through the rural and national mass media.
- ❖ Training of communities to manage funds, warehouses and input shops.
 1. Handbooks on managing village funds for farmer organizations were prepared.
 2. Manuals on managing stocks and shops for farmer organizations were developed.
 3. Input shops and fertilizer storage rooms were established.
- ❖ A network, with the collaboration of our NGO partners, linking farmer organizations, credit institutions, and the private sector actors (ie, fertilizer suppliers) of the sub-region was established.
- ❖ Scientific support and shared scientific knowledge with research partners.
 1. Workshops for training and experience sharing were organized.
 2. Exchange visits and field trips for producers within and between countries were organized.
 3. Technical backstopping was provided to project partners.

1. Introduction

1.1 Context

The semi-arid Sahelian zone of West Africa is one of the poorest regions on earth with one of the lowest human development indices. The climate is extremely harsh – semi-arid with an annual rainfall ranging from 350 to 700 mm per year. Inter-annual variability in the amount and the distribution of rainfall translates into sizeable year-to-year fluctuations in millet and sorghum yields.

Millet and sorghum are the predominant cereal crops and staple foods for the rural population in West Africa. Increased food needs in the region, driven by considerable population growth, have put more pressure on the fragile land use system. For instance, the region witnesses a general decline in the use of fallowing as a means of replenishing soil fertility and an increase in the use of marginal land and consequent land degradation.

1.2 Objectives

The main objectives of the USAID TARGET project were to (1) increase and stabilize production, farm household incomes, and food security; and (2) help farmers better manage the natural resource base through the uptake of fertilizer micro-dosing technology and better farmer-based cooperatives in the Sudano-Sahelian zones of Burkina Faso, Mali and Niger. The fertilizer micro-dose technology deals with the application of small quantities of inorganic fertilizers in the planting/seed hole to increase yields while minimizing input cost.

Recognizing that liquidity constraints often prevent farmers from intensifying their production system, the project also initiated, with the help of Projet Intrants FAO, the warrantage credit system to remove barriers to the adoption of soil fertility restoration. This credit system aims to assist the villagers to set up farmer organizations, fertilizer shops, and storage facilities, and to grant them access to cash credit. This enables farmers to purchase external inputs such as fertilizers and to store crops to get higher prices during periods when the market supply begins to decline.

This report describes the activities undertaken by the USAID TARGET project in Burkina Faso, Mali and Niger, between June 2002 and December 2004. More specifically, this document highlights the key achievements made by the program in reaching the following objectives:

1. Demonstrate and enhance the adoption of the fertilizer micro-dosing technology to improve the productivity and manage the natural resource base.
2. Establish sustainable community-based farmer organizations in the targeted regions so as to improve farmer's access to credit, other inputs, and output markets.
3. Assist in human development through technical training.
4. Promote policy and investment options that ensures the optimal use of natural resources.

2. Approach and Methods

The USAID TARGET project draws on the successful experiences development model used by the Projet Intrants FAO in the villages of Niger. The model promotes a system of credit adapted to the socio-economic conditions of the rural areas. It links the requirement for guaranteed credit to the necessity of adding value to the agricultural products while organizing producers for the supply of inputs. Demonstration trials were established in the farmers' fields, which were managed by the farmers themselves with the technical backstopping of the research and extension staff.

2.1 Selection of Project Study Sites

Project study sites were carefully selected using specific criteria (ie, rainfall level, type of soil, access to inputs) set by the project partners in each country. Areas within the Sudano-Sahelian zone with rainfall between 500 and 800 mm per year were chosen. Activities were carried out in the regions of Segou, Koulikoro and Mopti, in Mali; Niamey, Tillabery and Maradi, in Niger; and the Central Plateau of Burkina Faso (Figure 1 and Annexes 1a and 1b). The selected zones were characterized by predominantly sandy soils with a low inherent fertility. Villages in the selected areas were able to link with markets, had saving-credit associations, and had a comparative advantage in the production of millet and sorghum for local, national, and/or regional markets.

2.2 Setting Up of Demonstration Plots

Access to knowledge on latest technologies is highly useful for farmers to continuously improve their farming practices and for policy makers to formulate effective and forward-looking agricultural policy. During the 2002 and 2003 cropping seasons, the USAID TARGET project established 2530 demonstration plots (625 in 2002 and 1905 in 2003) of the fertilizer micro-dosing technology in Burkina Faso, Mali and Niger (Annex 2).

Several farmer leaders were selected on a voluntary basis to conduct demonstrations following mapped out guidelines. The project's research and extension partners (ie, NARES, IARCs, and NGOs) selected the demonstration plots in consultation with farmers, trained farmers, and provided technical backstopping through an open and participatory process. The farmers managed the trials by carrying out all the field operations from land preparation to sowing, weeding and harvesting. Visits were organized around the plots to promote the flow of information and knowledge between researchers and farmers.

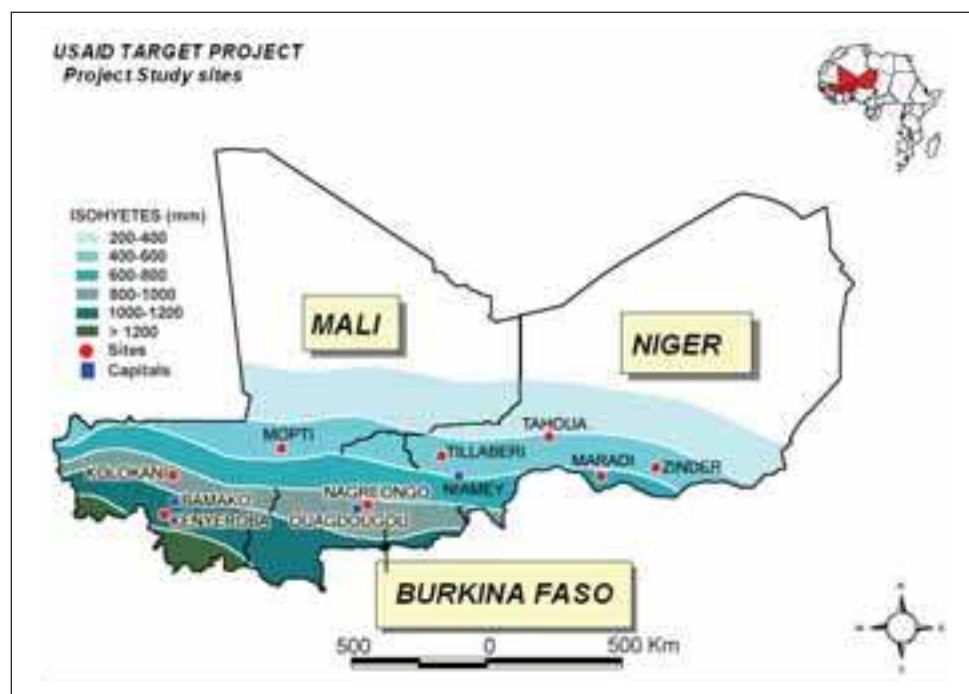


Figure 1: Map of USAID TARGET Project Study Sites in Burkina Faso, Mali and Niger.



On farm visits, researchers and farmers exchanging views, Niger 2004.

The demonstration trials were carried out in Burkina Faso and Mali on millet and sorghum crops, and on millet in Niger. The choice of millet or sorghum varieties used on the demonstration plots was left to the farmers. The plot sizes were 304 m² in Burkina Faso, 300 to 500 m² in Mali, and 200 m² to 600 m² in Niger. The fertilizers (formulation type of the compound fertilizer) used in the demonstration plots differed from one country to another, depending on the availability of the different formulations on the local markets. The dosage of fertilizer applied to the planting hill in the demonstration fields depended on its composition and the planting density. In Burkina

Faso, the fertilizer micro-dose rate was 4 g of NPK (15:25:15) per hill. An additional treatment consisting of the zai system (a small pit in which manure is placed to improve water collection/infiltration and nutrient use efficiency) was also tested. In Mali, 4 g of NPK (17-17-17) per hill was used, while in Niger the three fertilizer micro-dose rates were 6 g of NPK (15:15:15), 2 g DAP (18:46:0) and 2 g DAP + 1 g Urea (46:0:0) per hill. Planting densities were relatively higher in Burkina Faso and Mali than in Niger.

2.3 Establishment of Farmer Organizations and the Warrantage Credit System

The promotion of the fertilizer micro-dosing technology is closely tied to the availability, accessibility of fertilizers, and especially to the financial resources available to the producers for their purchases. Therefore, farmer-based cooperatives or producers' associations were established and village savings-credits associations were promoted to provide farmer's access to micro-credit. The inventory credit scheme or warrantage system allows farmers (or producer organizations) to mortgage their cereals at harvest time to secure a loan in order to carry out their income-generating activities during the off-season, without selling their grains at a lower price. These cereal grains and grains of other crops are kept in a clean store with a double lock. Buying inputs in a consolidated order from all the farmer groups enables cooperative members to purchase inputs at a lower price and of good quality at the beginning of the production cycle. The establishment of an inventory credit scheme also allows households to smoothen their consumption patterns, thus reducing consumption risk. The warrantage credit system was popularized in the targeted areas with the assistance of farmer organizations, commercial banks, NGOs and donors.



Grains kept in a warrantage store.



Double locking the store.



Farmer's inputs store.

2.4 Establishment of Farmer Field Schools (FFS)

Farmer field schools (FFS) were established in 2004 to familiarize farmers with the fertilizer micro-dosing technology, increase their knowledge base on natural resource management, and thereby widely disseminating the new technology in targeted areas. Farmer field schools were set up at four sites in Niger: Fada zeno and Konkorido in the region of Dosso; and Guidan idder and Doguerawa in the region of Tahoua with the CIVT millet variety to showcase millet yields under the fertilizer micro-dosing technology. The FFS were used to train, as interns, selected farmers in the targeted areas and from neighboring villages on various agricultural subjects. These farmer trainees served as extension agents and field technicians during farmer field days. The schools on millet and sorghum were established near heavy-trafficked areas of the targeted zones in Burkina Faso to showcase fields with and without the micro-dose technology.



Farmer field schools at Dosso, Niger 2004.



Visiting farmer field schools at Kaya, Burkina Faso 2004.

2.5 Capacity Building

Training is a key element to build and strengthen the knowledge of farmers, partners, and scientists in order to make the project activities more sustainable. The project used various tools, such as the FFS, farmer field days, handbooks and manuals, workshops, exchange visits and field trips, to strengthen and build human resources in the targeted areas. Farmers were trained on the concept of warrantage, the micro-dose technology, and the management of village funds, warehouses, and input shops. Project partners were trained in the areas of participatory research techniques to disseminate technology on a wide scale and on data collection methods.

2.6 Collection and Analysis of Agronomic and Socio-Economic Data

Periodic follow-up trips were conducted at the national and regional levels by field technicians to supervise project activities, collect data, communicate and to bring technical support and advice to farmers. During the 2002 and 2003 cropping seasons, agronomic and socio-economic data were gathered from demonstration trial sites in selected countries. Data on warrantage activities (ie, funds loaned, loan repayment rates) were also collected by the members of producers' associations and by various actors involved in the sale or storage of inputs. The agro-economic performance of the micro-dose technology was assessed using the data collected on the demonstration sites, which were analyzed with the GENSTAT software.

3. Results and Achievements

3.1 Raising soil fertility

Burkina Faso

In Burkina Faso, several on-farm trials were conducted to evaluate the performance of millet and sorghum under the fertilizer micro-dosing technique, the earlier recommended fertilizer rates and the farmer's/traditional practice.

The results of the trials indicated an increase of 44% in the millet grain yields in 2002 (680 kg ha⁻¹ vs 473 kg ha⁻¹) and 75% in 2003 (823 kg ha⁻¹ vs 471 kg ha⁻¹), using the fertilizer micro-dosing technology, as compared to the farmer's practice (Figure 2). Moreover, the 2003 results revealed that millet yields with the fertilizer micro-dosing treatment were 18.5% higher than those with the Zai treatment. Overall, no significant difference was observed over the two years between the micro-dose and the earlier recommended fertilizer treatments, though the total quantity of fertilizer used per hectare is higher in the latter than in the former.

Concerning sorghum, the largest grain yields resulted from the application of 125 kg ha⁻¹ of NPK (15:25:15). Grain yields under the fertilizer by micro-dose technology were 48% higher in 2002 (789 kg ha⁻¹ vs 534 kg ha⁻¹) and 82% higher in 2003 (857 kg ha⁻¹ vs 472 kg ha⁻¹) than the control treatments (farmer's practice with no fertilizer) (Figure 3). In 2003, the yields from the zai treatment were 42% lower than the

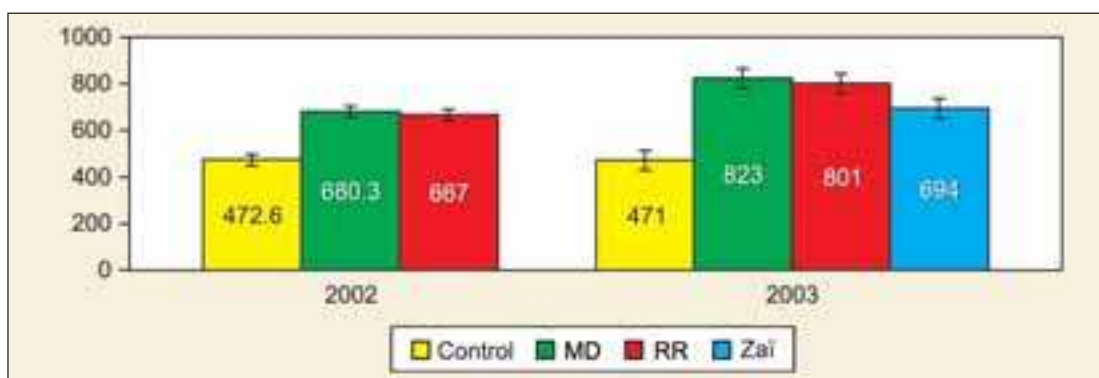


Figure 2: Grain yields (kg ha⁻¹) of millet (Control, Micro-Dose (MD), Recommended Rates (RR), and Zai), Burkina Faso, 2002 and 2003.

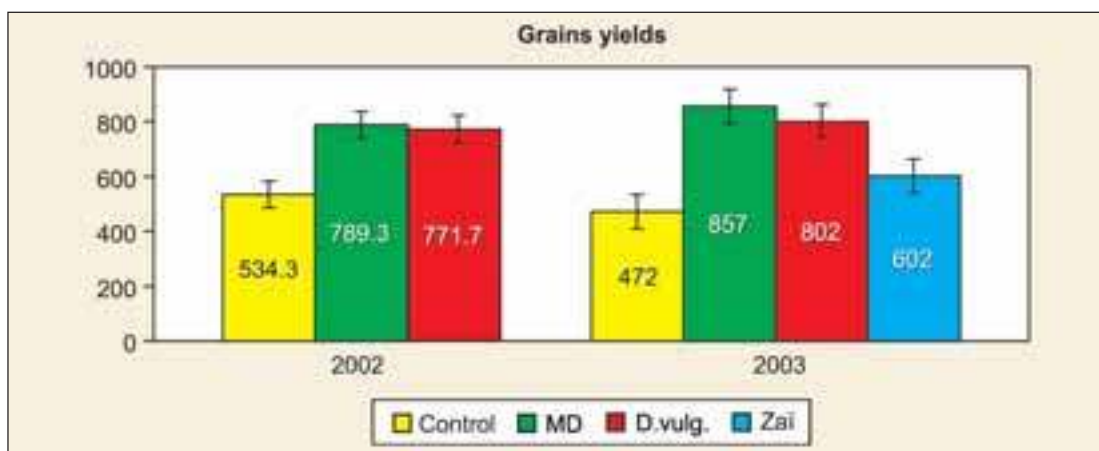


Figure 3: Grain yields (kg ha⁻¹) of Sorghum (Control, Micro-Dose (MD), Recommended Rates (RR), and Zai) in Burkina Faso, 2002 and 2003.

grain yields from the micro-dose (602 kg ha^{-1} vs 857 kg ha^{-1}). The multi-annual results indicated that grain yields under the fertilizer by micro-dose technology exceeded those of the unfertilized fields by 69%. Again, there was no sizeable difference observed between sorghum yields under the micro-dose treatment and the recommended fertilizer rates. Millet and sorghum fodder yields followed the same trends as the grain yields and were clearly greatest under the micro-dose technology.

Mali

In Mali, the largest millet and sorghum grain yields resulted from the application of 80 and 120 kg ha^{-1} of NPK (17:17:17), respectively. Millet grain yields under the fertilizer by micro-dose technology were 61% higher in 2002 (756 kg ha^{-1} vs 469 kg ha^{-1}) and 90% greater in 2003 (1463 kg ha^{-1} vs 768 kg ha^{-1}) than the yields from the farmer's practice plots (Figure 4). Sorghum yields increased by 107% in 2002 (1053 kg ha^{-1} vs 508 kg ha^{-1}) and by 69% in 2003 (1447 kg ha^{-1} vs 858 kg ha^{-1}) (Figure 5). The results indicated that millet and sorghum yields under the new technology exceeded those under the recommended treatments (100 kg ha^{-1} of NPK) by 19% and 28% in 2002 and 23% and 11% in 2003, respectively. The multi-annual analysis showed that the sorghum yields under the micro-dose technology are 77% and 15% greater than with the control and recommended treatments, respectively.

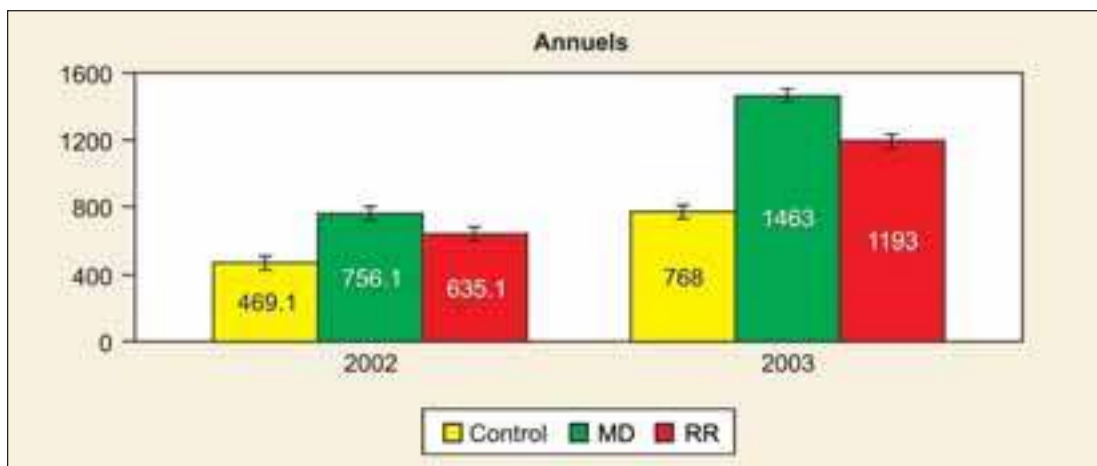


Figure 4: Grain yields (kg ha^{-1}) of millet (Control, Micro-Dose (MD), and Recommended Rates (RR)), Mali, 2002 and 2003.

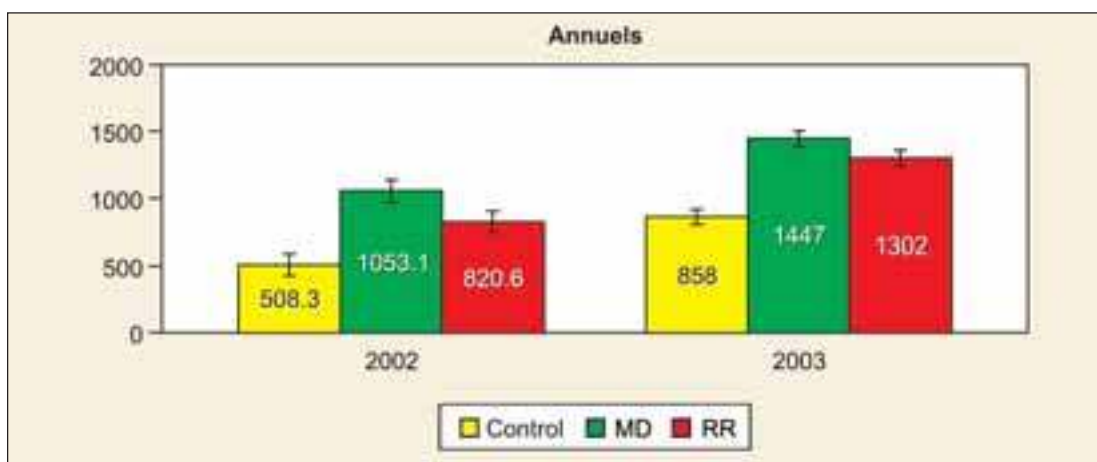


Figure 5: Grain yields (kg ha^{-1}) of sorghum (Control, Micro-Dose (MD), and Recommended Rates (RR)), Mali, 2002 and 2003.

Furthermore, the results of the economic analysis revealed that, in 2002, the net profits realized under with the micro-dose technology (119690 FCFA ha⁻¹ for millet and 91064 FCFA ha⁻¹ for sorghum) were greater than those in the absence of fertilizers (71167 FCFA ha⁻¹ for millet and 68584 FCFA ha⁻¹ for sorghum) and those under the recommended treatments (89959 FCFA ha⁻¹ for millet and 68584 FCFA ha⁻¹ for sorghum).

Niger

In Niger, the design of trials was greatly facilitated by the experiences acquired under the collaborative work with the Projet Intrants FAO. Various types of fertilizers applied in small doses to the planting hill were compared to unfertilized fields. For instance, 60 kg ha⁻¹ of NPK (15:15:15), 20 kg ha⁻¹ of di-ammonium phosphate (DAP) (18:46:0), and 20 kg ha⁻¹ of DAP and 10 kg ha⁻¹ of Urea (46:0:0) were tested on a 200 m² to 600 m² plots.

There was a marked response in millet grain yields and net gains from the application of fertilizers in all treatments (NPK, DAP, and DAP + Urea). However, yields and profitability were greater with the treatment of DAP + Urea than with the other micro-dose treatments. For instance, the multi-year results indicated that the application of DAP+Urea increased yields by 91% (722 kg ha⁻¹ vs 378 kg ha⁻¹) compared to the control (0 fertilizer) and by about 10% with respect to DAP and NPK treatments (Figure 6). In addition, the results of the economic analysis on millet revealed that, in 2002 and 2003, the net gains realized with the DAP + Urea micro-dose treatment (74650 FCFA ha⁻¹ in 2002 and 116478 FCFA ha⁻¹ in 2003) clearly exceeded those in the absence of fertilizers (51745 FCFA ha⁻¹ in 2002 and 52643 FCFA ha⁻¹ in 2003) and those under the NPK and DAP treatments (Figure 7).

Yields by Agro-Ecological Zones

Two main findings emerged from the multi-year analysis by agro-ecological zones for the two years. First, the results indicated that the fertilizer by micro-dose technology markedly increases sorghum grain yields in agro-ecological zones with average annual rainfall of 400 and more than 1000 mm per year. However, the fertilizer by micro-dose technology has the greatest impact on grain yields in zones where the annual precipitation levels exceed 1000 mm per year. Only in such areas, the grain yields with the micro-dose treatments were greater (26%) than those with the recommended rates. Compared to unfertilized trials, the application of fertilizer by micro-dose increased sorghum grain yields by 76%, 66%, and 81% in zones with the annual rainfall of 400–600 mm, 600–1000 mm, and more than 1000 mm per year, respectively (Figure 8).

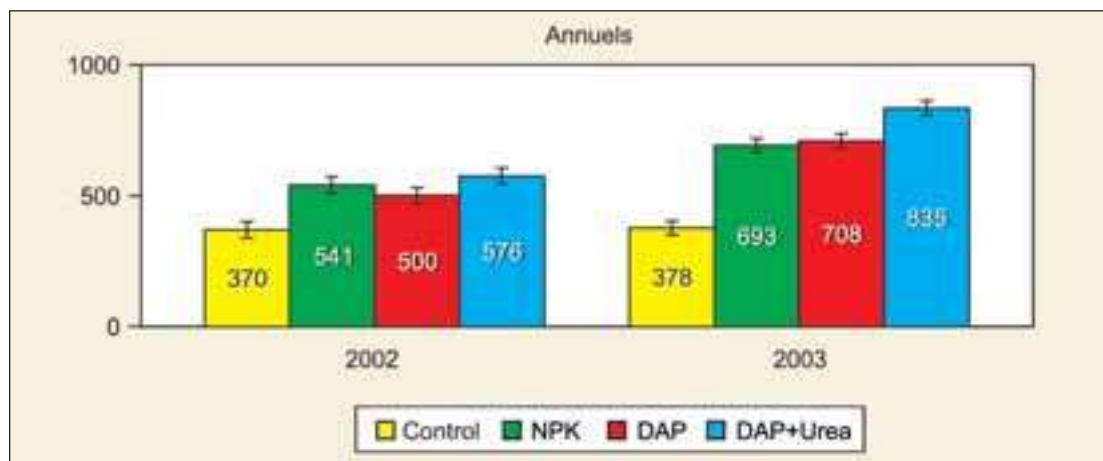


Figure 6: Grain yields (kg ha⁻¹) of millet (Control and Micro-Dose) in Niger, 2002 and 2003.

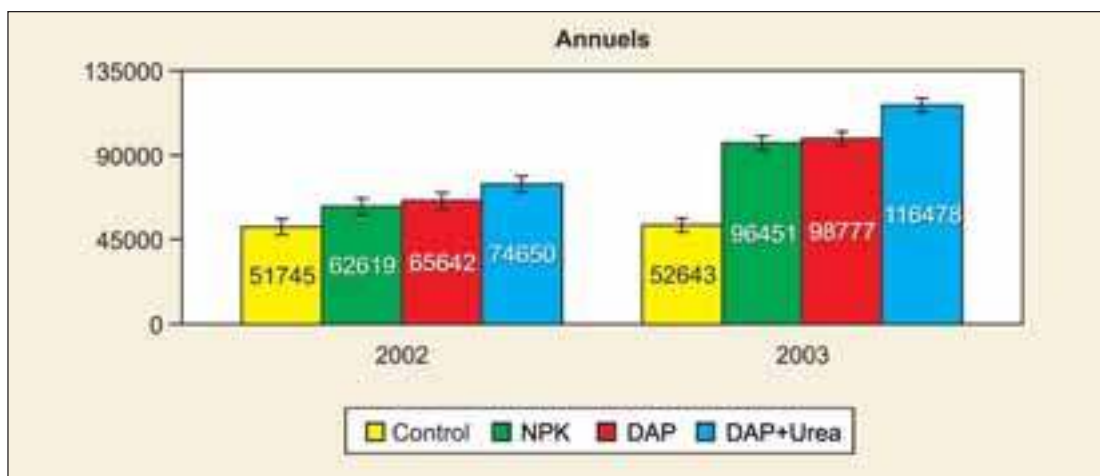


Figure 7: Net gains (FCFA ha⁻¹) from millet grown under fertilizer micro-dosing technology and farmers' practice, Niger, 2002 and 2003.

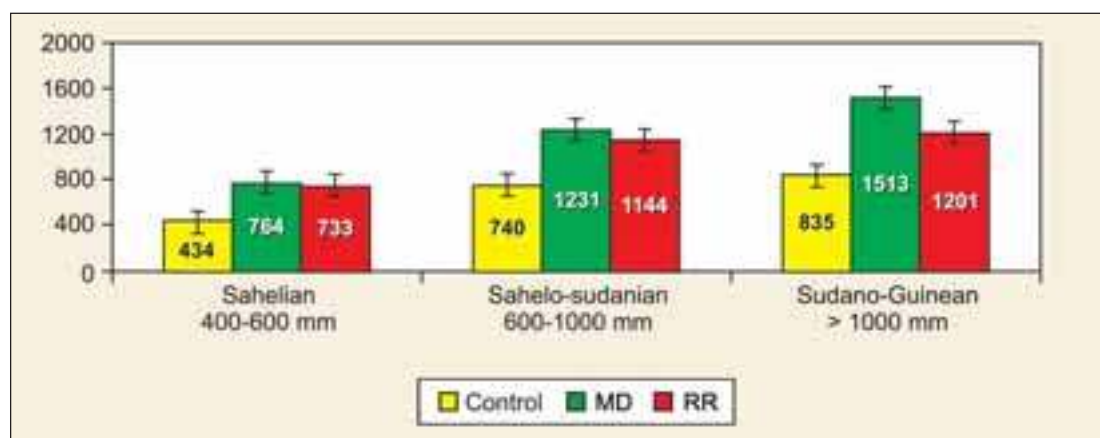


Figure 8: Grain yields (kg ha⁻¹) of sorghum by Agro-Ecological Zone, 2002 and 2003.

Concerning millet, the application of fertilizer by micro-dose produces higher grain yields in semi-humid zones of 600 to 1000 mm rainfall per year than in drier areas (< 400 to 600 mm) (Figure 9). There was no significant difference observed between the various fertilizer treatments in the three agro-ecological zones studied.

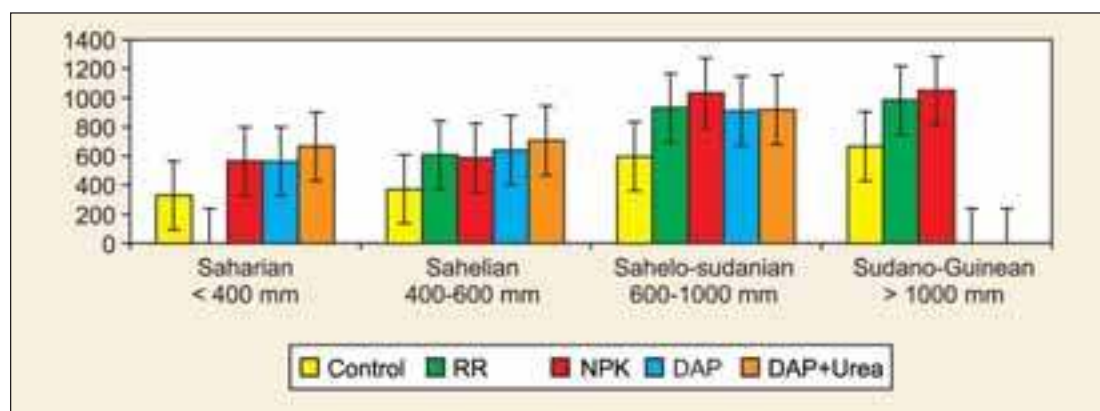


Figure 9. Grain yields (kg ha⁻¹) of millet by Agro-Ecological Zone, 2002 and 2003.

3.2 Improving farmers' access to credit and inputs through the warrantage credit system

During the first year of the project in 2002/2003, the warrantage or inventory credit system was tested only in Mali and Niger. It was initiated in Burkina Faso in the second year, 2003/2004. In all the three countries, approximately 60 farmer organizations were involved in the warrantage system over the two-year period of the project, with a total credit of 73602599 FCFA from the Decentralized Financial Systems (DFS).

Burkina Faso

The warrantage credit system was initiated in 2003 in Burkina Faso with only 8 farmer organizations in the targeted areas. Some villages were already receiving financial assistance from the DFS that are affiliated to the NGOs operating in the villages, to undertake income-generating activities. In 2004, about 250 farmer associations in the targeted areas participated in the micro credit program (Table 1). Producers, for the most part, stored millet, sorghum and groundnuts. The results indicated that of the 4415000 FCFA loan amount requested, farmers were only granted 1449000 FCFA, or about 30% of the amount asked. Moreover, only farmers in the north zone of the country were granted credit, as those in the center and middle-center zones requests for credit were denied. The lack of credit in those areas was a great impediment to the conduct of income-generating activities and could also potentially limit the adoption of the fertilizer micro-dosing technology.

Table 1. Status of warrantage credit system in Burkina Faso, as of March 2004.

	Zone Centre	Zone Centre-nord			Zone Nord			
	Malgrétinga	Nionko	Talle	Kassirin	Kaïn	Thiou	Oula	Pobé
Product Stocked(kg):								
Sorghum	1000	6000	900	1700	1400	1600	400	335
Millet	2600	0	0	0	4300	200	50	2502
Rice	100	0	0	0	0	2500	250	0
Maize	700	0	0	0	0	0	0	0
Cowpea	900	0	0	0	1900	1200	450	2573
Groundnuts	2400	0	500	0	4284	3200	10700	417
Sesame	0	0	0	0	0	100	0	63
Voandzou	100	0	0	0	50	0	0	404
Bissap	400	0	0	0	0	0	0	0
Graines d'oseille	0	0	0	0	0	0	250	0
Total Farmers	30	17	15	20	44	35	67	28
Loan: Amount Requested (FCFA)	700000	496000	147000	291000	700000	749000	724000	608000
Loan: Amount Granted (FCFA)	0	0	0	0	700000	749000	0	0

Mali

In Mali, the farmers in the targeted areas benefited from the credit system established with the help of several NGOs (SG2000, ADAF/Galle, and Winrock International) during the 2002–2003 and 2003–2004 cropping seasons. Producers put in stock large quantities of millet, sorghum, and rice paddy (73,724 kg in 2002–2003) and were granted 10233655 FCFA in 2002–2003 and 16351100 FCFA in

2003-2004 (Tables 2 and 3). The farmers were charged a loan fee that amounted to about 3% of the loaned amount. Their total net benefits were in the order of 2709725 FCFA in 2003–2004. The farmer associations involved in warrantage activities used the credit to undertake income-generating activities (ie, steam and trade of rice, sheep fattening, small business, groundnut oil extraction, etc). The farmers also used the profits realized under the warranting schemes to purchase fertilizer and seeds of improved varieties for the next cropping season.

Table 2. Status of warrantage credit system in Mali, 2002/2003.

NGO Partners	Villages	Products Stocked	Quantity	Loan Amount	Management Fees (FCFA)	Net Benefits (FCFA)
			Stocked (kg)	Granted (FCFA)		
SG 2000	Kondogola	Mil	4000	360000	4000	236000
		Niamabougou	Mil/sorgho	28500	4246500	13200
	Sélinkégny	Paddy	2000	580000	79000	Own Consumption
		Mais/mil	3800	482000	-	
		Paddy	4200	420000	100000	Consumption
		Tioribougou	Sorgho	4000	619500	10500
ADAF/Gallé	Kénioroba	Mil/sorgho	6885	1141000	-	91415
Winrock International	Tissala	Mil/sorgho	6200	620000	46500	356000
	Sofara	Paddy	13107	1638375	-	215547 (both)
		Sorgho	902	126280	49925	
Total	8 villages		73724	10233655	-	1726462 + Own Consumption

Table 3. Status of warrantage credit system in Mali, 2003/2004.

NGO Partners	Products Stocked	Loan Amount Granted (FCFA)	Gross Profit (FCFA)	Management Fees (FCFA)	Net Profit (FCFA)
SG2000	Millet, Sorghum, Maize, Rice Paddy	6628600	8339000	325500	1384900
ADAF Gallé	Millet, Sorghum,	2850000	3135000		285000
WI/MALI	Millet, Sorghum, Rice Paddy	6872500	7978750	96425	1009825
Total		16351100	19452750	421925	2679725

Niger

In Niger, 40 farmer associations were involved in the warrantage credit scheme in 2003-2004 compared to 23 in 2002–2003. In 2002/2003, the DFS financed about 34069300 FCFA, or approximately 93% of the value of the stored grains under the warrantage system. Income-generating activities that were pursued by farmers using this credit included groundnut oil extraction, vegetable gardening, sheep fattening, small trade, etc. In 2003/2004, the local decentralized financial system was able to raise 11500000 FCFA for the warrantage activities in the targeted areas (Tables 4 and Figure 10). However, these funds were not sufficient to meet the demands of the producers at the opportune time. The acuity of the problem was particularly severe in the regions of Zinder and Maradi, where no financing was available. Farmers from regions that received some credit undertook various income-generating activities (ie, small trade) and purchased inputs.

Table 4. Status of warrantage credit system in Niger, 2002/2003.

Regions	Departments	Villages	Value of Stocks (FCFA)	Loan Amount Granted (FCFA)
Dosso	Dosso	Dosso Koira tégui	1193400	1193000
Dosso	Dosso	Sambera Zeno	3729500	3729500
Dosso	Gaya	Téla	2434000	2434000
Total Dosso			7356900	7356500
Maradi	Madarounfa	Hadamna	1117500	1100000
Maradi	Guidan Roumji	Dargue	1503000	1300000
Maradi	Madarounfa	Dan Tambara	437000	437000
Maradi	Madarounfa	Garin Maigari	335000	300000
Maradi	Maradi	Kontagora	532000	500000
Maradi	Madarounfa	Boko	1300000	1000000
Maradi	Madarounfa	Gabi	1120000	1000000
Maradi	Madarounfa	Tokarawa	1000000	1000000
Maradi	Madarounfa	Garin Gonaou	1000000	300000
Maradi	Madarounfa	Ouban Dawak wodatou	900000	800000
Total Maradi			9244500	7737000
Tahoua	Konni	Dolé	52000	5201000
Tahoua	Konni	Gidan Idder	4920000	4920000
Tahoua	Madaoua	Maizabi	1885800	1885800
Tillabéry	Say1	Ouro Modibo	682500	682500
Tillabéry	Say1	Tampachouna	494000	494000
Tillabéry	Say1	Bokki	1300000	1300000
Tillabéry	Kollo	N'gamdey	892500	892500
Total Tillabéry			10226800	15375800
Zinder	Mirriah	Zermou	2000000	2000000
Zinder	Tanout	Ya Gaji	850000	600000
Zinder	Tanout	Sabon Kafi	1650800	1000000
Total Zinder			4500800	3600000
TOTAL			31329000	34069300

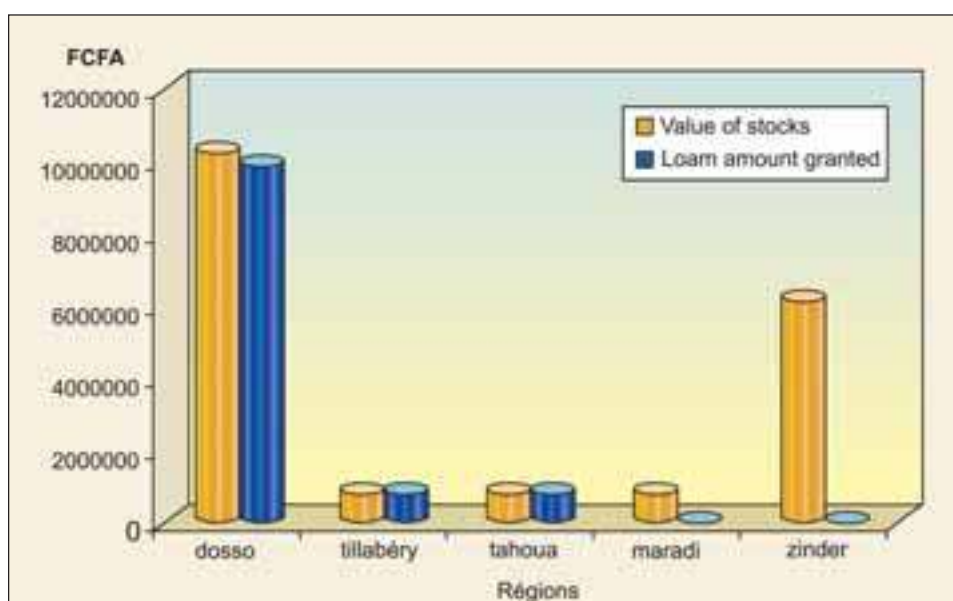


Figure 10: Status of warrantage credit system in Niger, 2003/2004.

3.3 Capacity building

Workshops

i. Warrantage credit system in Burkina Faso

A training workshop on the warrantage credit scheme was held from 9 to 10 October 2002, in Kamboinsé, Burkina Faso, at the Agricultural Environmental Formation and Research Center (CREAF) of INERA. Eighteen participants from several institutions, such as ICRISAT, Projet Intrants FAO, INERA, FNGN, ADRK, and Hunger project, took part in this workshop (Annex 3). The objectives of the workshop were to acquaint the partners of Burkina Faso with the warrantage credit system, to draw from the experiences of Niger farmers with the system,



Workshop on the Warrantage Credit System.

and to assess the viability of starting the credit system in some villages of Burkina Faso. Staffs from Projet Intrants FAO were the resource persons who facilitated the workshop. The participants interacted to concertedly define the action plan and the framework within which the USAID TARGET project was to launch the warrantage credit system in Burkina Faso. The participants also visited the demonstration of fertilizer micro-dosing trials in the Kaya and Malgrentega regions, and interacted with farmers in these regions.

ii. Synthesis of 2002–2003 project activities and work plans

A regional workshop to present the project results for 2002–2003 and to plan future activities was held in ICRISAT/Sadoré from 15 to 17 April 2004. Partners and scientists from Burkina Faso, Mali, and Niger, involved in all aspects of the project, shared their experiences on the micro-dose and warrantage activities (Annex 4). They also planned the activities to be undertaken in 2003/2004. A field trip was also organized in Bokki (a village site of the project located at 25 km from ICRISAT, Sadoré) to show partners a service center established for warrantage activities and input shops.

The presentations during the workshop covered the following subjects:

- ❖ Problems pertaining to farmers' access to inputs (fertilizer and micro-credit)
- ❖ Summary of fertilizer by micro-dose and warrantage activities in Mali
- ❖ Review of fertilizer micro-dosing and warrantage activities by ICRISAT and INRAN
- ❖ Summary of fertilizer micro-dosing activities in Burkina Faso
- ❖ Examination of the socio-economic impact of the fertilizer micro-dosing and warrantage credit system
- ❖ Follow-up evaluations of the technology in Fakara

- ❖ Strengths and weaknesses of the fertilizer micro-dosing and warrantage credit system
- ❖ Planning of 2003–2004 activities

iii. Scaling up the adoption of the fertilizer micro-dosing technology in the region

To strengthen the capacities of the partners involved in the project, the regional coordination of the project requested that IFDC-Africa brainstorms with them in order to find the possibilities to scale up the micro-dose technology and disseminate it more widely in the region.

Nineteen (19) staff from national agricultural research institutions (INERA, INRAN, IER), NGOs (Sasakawa Global 2000, Winrock International, ADAF/Galle, ADRK, FNGN, Hunger Project, Projet Intrants FAO) involved in the project and from ICRISAT and IFDC participated in the workshop held at Ouahigouya, Burkina Faso, from 20 to 24 January 2004. (Annex 5).



Training workshop on scaling-up, Ouahigouya, Burkina Faso, 20–24 January 2004.

The participants were taught to examine the institutional and economic context of the project target areas before adopting an approach to disseminate information. They were familiarized with adults learning cycles and associated concepts they should strive to integrate into the participative development approach, and about various economic analysis tools.

In addition, they examined the role that financing systems (ie, credit and saving associations and warrantage credit system) can play in facilitating the wide dissemination of new technologies in the region. Finally, they learned important institutional development concepts, examined linkages between the micro-dose project and economic and institutional context, and identified opportunities



to up-scale the adoption of the fertilizer by micro-dose technology in the region.

Training Workshop on Scaling-Up, Ouahigouya, 20–24 January 2004, Burkina Faso.

Participatory training activities

i. Training of farmers

The project ensured that human capacity building activities (ie, farmer field days, field trips, farmer field schools) were implemented through the participative training of farmers on

1. techniques of fertilizer application in micro-doses. NGO partners in their respective zones of intervention held these training activities at the beginning of the cropping season;
2. management of village infrastructures (warrantage storage units, input shops, and village funds); and
3. the concept of warrantage and rules and regulations pertaining to the management of the inventory credit scheme in order to create a sound financial environment.

ii. Training on the use of fertilizers and their application in micro-doses

From 3 to 12 May 2003, a joint mission of ICRISAT, INRAN and Projet Intrants FAO was conducted in the five regions selected in Niger for the testing and diffusion of micro-dose technologies. The objectives of the mission were to strengthen field agents' knowledge on the concepts of mineral fertilization, to practise the installation of the demonstrations in accordance with the guidelines developed, to teach farmers to apply fertilizer in micro-doses. The training mission gathered more than 220 participants composed of 80 field agents (agriculture engineers and advisors, chiefs of agricultural district, and extension) who underwent, in their regional entity, 48 hours of training, and 140 demonstrators who were farmers from 6 villages. The participants led the way in installing and planting in demonstration sites.



Training of farmers on fertilizer micro-dosing technology, Niger 2004.

iii. Training on survey forms and on the collection of socio-economic data

In December 2002, at Niger, thirty agents were trained in filling survey forms and on the collection of socio-economic data from the fertilizer micro-dose demonstration trials.

iv. Training on various agricultural topics and exchange visits

Exchange visits were organized during which farmers, NGOs and INERA scientists from Burkina Faso traveled to Niger for field visits and interactions with the project partners in Niger (Annex 5). Field trips were organized in three village sites of the project in Niger from 25 to 29 January 2003. The objectives of the trips were to train participants on various agricultural themes, such as the application of fertilizer by micro-dose, financial transactions, operating input shops, and the warrantage credit system. This was an enriching and rewarding experience for the project partners from Burkina Faso who did not have any experience with the warrantage credit system. They learned a lot from the farmer organizations in Niger and were determined to start the warrantage system as soon as they returned to Burkina Faso.



Training of farmers on warrantage, Mali, 2002.

4. Conclusions and Future Perspectives

This report has provided a summary of the activities undertaken by the USAID TARGET project in the Sudano-Sahelian zones of Burkina Faso, Mali and Niger, between June 2002 and December 2004.

The project has made substantial progress in achieving its stated objectives of helping farmers better manage the natural resource base through the uptake of fertilizer micro-dosing technology and better farmer-based cooperatives. The results of the demonstration trials indicated that millet and sorghum grain yields substantially increased in all regions through the applications of small quantities of fertilizer along with seed at planting.

Furthermore, the results revealed that farmers' access to credit and inputs was greatly improved through the warrantage credit system. More importantly, farmers who were involved in warrantage activities used the credit to undertake income-generating activities and to purchase fertilizer and seeds of improved varieties for the next cropping systems.

Finally, the project adopted an open and participatory approach and used various tools, such as the FFS, handbooks and manuals, workshops, and field trips, to strengthen and build human capacity in the targeted areas. The FFS, which was started in 2004, proved to be an efficient mechanism for scaling up the fertilizer micro-dosing technology and the warrantage system. There is a need to pursue this activity (farmer field schools) in all the participating countries (Burkina Faso, Mali and Niger) during the next two to three years to ensure that these technologies are widely disseminated and adopted by the end users. A proposal for additional funds from the USAID is being prepared for capitalizing on the gains obtained from the USAID TARGET project.

Project Coordinator: Dr Ramadjita Tabo, ICRISAT, Niamey, Niger

Project Team Members

I. ICRISAT: Ousmane Hassane, Maimouna K. Diallo, Saidou Koala, Bruno Gerard and Jupiter Ndjeunga

II. TSBF-CIAT: Andre Bationo and Adamou Abdou

III. IFDC: Arno Maatman and Abdou M. Konlambigue

IV. Burkina Faso

- a. INERA: Sibiry Jean Baptiste Taonda, Pale Siebou, Ouattara Korodjouma and Ilboudou Blaise
- b. FNGN: Madibaye Djimadoum
- c. Hunger Project: Hamadou Tapsoba
- d. ADRK: Jules Singbeogo

IV. Mali

- a. IER: Diakala Sogodogo
- b. Winrock International: Niels Hanssen and Sako Karamako



Discussions between farmer groups, scientists and extension agents, Niger 2003.

- c. Sasakawa Global 2000: Sandinan Boubacar and Marcel Galiba
- d. ADAF-GALLE: Biraima Diall

V. Niger

- a. INRAN: Annou Garba and Jean Pierre Atindehou
- b. Projet Intrants FAO: Daniel Marchal and Bassirou Amadou

For additional copies of this report or further information on the USAID TARGET PROJECT, please contact:

Dr. Ramadjita Tabo
ICRISAT-NIAMEY BP 12404 Niamey (via Paris) Niger
Phone: (227) 72 26 26 or 72 25 29
Email: r.tabo@cgiar.org or icrisat@cgiar.org
Web site: <http://www.icrisat.org>

Annexes

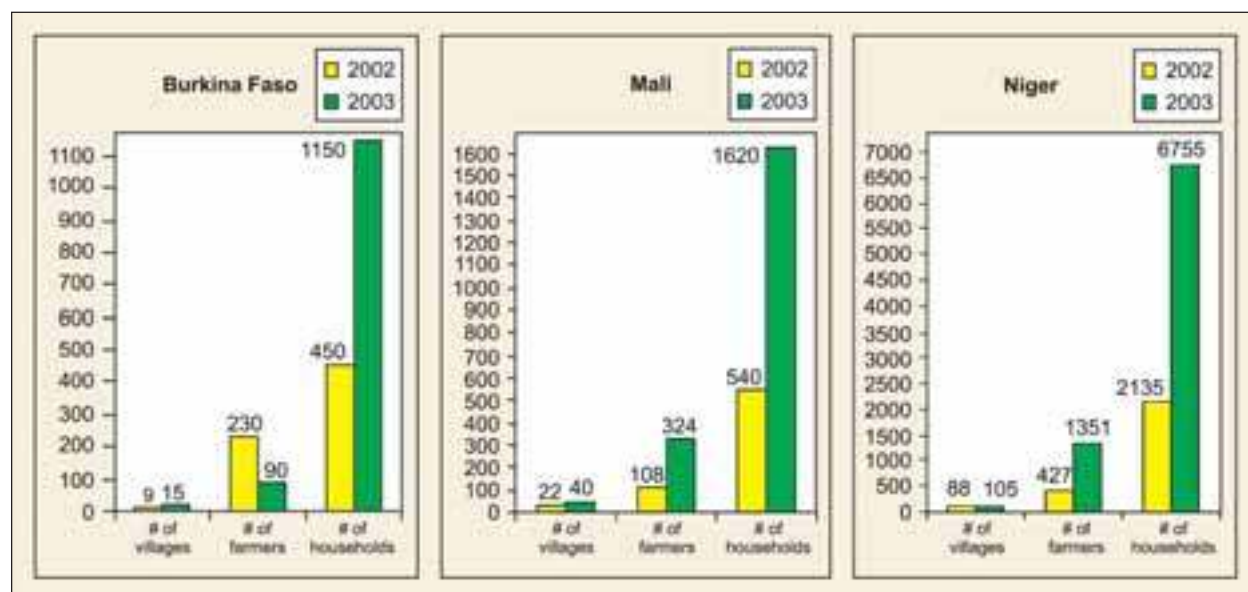
Annex 1a. Project study sites and partners in Burkina Faso and Mali.

Country	Intervention Zones	NGO Partners	Rainfall Margins (mm)
Burkina Faso	Zone centre	Hunger Project	700–800
	Zone centre – nord	ADRK	450–750
	Zone nord	FNGN	450–750
Mali	Mandé	ADAF/Gallé	1000–1200
	Bélédougou	ADAF/Gallé	600–800
	Bélédougou	SG 2000	600–800
	Segou	SG 2000	600–800
	Sanando	Winrock International	800–1000
	Mopti	Winrock International	400–600

Annex 1b. Project study sites in Niger.

Regions	Departments	Rainfall Margins (mm)
Zinder (Nord)	Gouré, Tanout	< 400
Dosso, Maradi, Tillabery, Tahoua	Dosso, Doutchi, Tessaoua, Kollo, Say, Konni	400–600
Dosso (sud)	Gaya,	> 600
Maradi (sud)	Madarounfa,	
Zinder (sud)	Magaria, Matameye	

Annex 2. Number of demonstration trials, farmers and households in Burkina Faso, Mali and Niger, 2002 and 2003.



Annex 3. Warrantage workshop participants, CREAM Kamboinsé, Burkina Faso, 9–10 October 2002.

Name	Institution	Address
1. Gérard Bruno	ICRISAT	BP 12404 Niamey Tel 227 722626 b.gerard@cgiar.org
2. Ousmane Hassane	ICRISAT	BP 12404 Niamey Tel 227 722626 o.hassane@cgiar.org
3. Comfort Manyame	ICRISAT	BP 12404 Niamey Tel 227 722626 c.manyame@cgiar.org
4. Tabo Ramadjita	ICRISAT	BP 12404 Niamey Tel 227 722626 r.tabo@cgiar.org
5. Abdoulaye Saley Moussa	ICRISAT	BP 12404 Niamey Tel 227 722626 a.moussa-saley@cgiar.org
6. Palé Siébou	INERA	BP 10 Koudougou, palesiebou@hotmail.com
7. Ouattara Korodjouma	INERA	Korodjouma_ouattara@hotmail.com
8. Ouattara Badiori	INERA	BP 476 Ouagadougou, badiori.ouattara@coraf.org
9. Taonda Sibiri J.B.	INERA	BP 10 Koudougou, Tel 446510, staonda@hotmail.com
10. Savadogo Noufou	FNGN	Tel 554292, fugn@fasonet.bf
11. Ouegraogo Issifou	FNGN	Tel 554292, fugn@fasonet.bf
12. Hamado Tapsoba	Hunger Project	Tel 307110, htapsoba@yahoo.fr
13. Sankara Patrice	Hunger Project	Tel 816685
14. Bachir Amadou	Projet FAO Intrants	Tel 227 733236, pintrant@intnet.ne
15. Daniel Marchal	FAO Niger	Tel 227 723236, pintrant@intnet.ne
16. Birba Athanase	FEPA-B	Tel 333875, cnpab@zcp.bf
17. Dao Bassiaka	FEPA-B	Tel 333875, cnpab@zcp.bf
18. Nandnaba Siméon	ADRK	BP 54 Kaya, adrkkaya@hotmail.com

Annex 4. List of participants at the workshop on synthesis of 2002–2003 project activities and work plans, 15–17 April 2004, Niamey, Niger.

Name	Institution	Address
Palé Siébou	INERA	BP 10 Koudougou, palesiebou@hotmail.com
Ouedraogo Issifou	FNGN	Tel 554292, fugn@fasonet.bf
Singbeogo Jules	ADRK, Kaya	ONG ADRK, Kaya, adrk@fasonet.bf
Hamado Tapsoba	Hunger Project	Tel 307110, htapsoba@yahoo.fr
Karamoko Sako	Winrock International	223 229 38 80, skaramoko@yahoo.fr
Baraima Diall	ADAG/GALLE	adafgalle@afribone.net.ml
Diakalia Sogodogo	IER/Cinzana	EIR, Bamako, Mali, diakalia.sogodogo@ier.ml
Boubacar Sandinan	Sasakawa 2000	Sg2000@afribone.net.ml
Maman Fari	AQUADEV	ONG Aquadev Zinder, Niger
Maimouna Aboubacar	AQUADEV	ONG Aquadev Zinder, Niger
Ayouba Hassane	Mooriben	ONG Mooriben, Niger, mooriben@intnet.ne
Daniel Marchal	FAO Niger	Tel 227 723236, pintrant@intnet.ne
Bachir Amadou	Projet FAO Intrants	Tel 227 733236, pintrant@intnet.ne
Bassirou Issa	FAO-Intrant/Zinder	Maradi, Niger, pintrant@intnet.ne
Coulibaly Mamadou	FAO-Intrant/Maradi	Maradi, Niger, pintrant@intnet.ne
Alka Boubacar	FAO-Intrant/Maradi	Maradi, Niger, pintrant@intnet.ne
Salissou Oumarou	PCLM Mayahi/Maradi	Projet Mayahi, lcpmy@undp.org
Annou Garba	INRAN	INRAN, Niger, inran@intnet.ne
Gandah Mahamadou	INRAN	Niamey, Niger, inran@intnet.ne
Moustapha Amadou	INRAN	Niamey, Niger, inran@intnet.ne
Cherif Oumar	INRAN	Cerra Maradi, Niger
Sabiou Maman	INRAN	CERA Tahoua, sabioumahamane@yahoo.fr
Zarafi Hassane	INRAN Economist	INRAN, Niamey, inran@intnet.ne
Saidou Koala	ICRISAT	BP 12404, Niamey, Tel. 227 722626, ICRISAT
Tabo Ramadjita	ICRISAT	r.tabo@cgiar.org
Gerard Bruno	ICRISAT	b.gerard@cgiar.org
Ouendeba Botorou	ICRISAT	BP 12404, Niamey, Tel. 227 722626, ICRISAT Niamey
Ousmane Youm	ICRISAT	BP 12404, Niamey, Tel 227 722626, ICRISAT Niamey
Gospel Omanyia	ICRISAT	BP 12404, Niamey, Tel 227 722626, ICRISAT Niamey
Abdoulaye S. Moussa	ICRISAT/TSBF	ICRISAT Niamey, a.moussa-sale@cgiar.org
Ousmane Hassane	ICRISAT	ICRISAT Niamey, o.hassane@cgiar.org
Abdoulaye Amadou	ICRISAT	ICRISAT Niamey
Ibrahim Maikano	ICRISAT	ICRISAT Niamey, i.maikano@cgiar.org
Ousmane Abdou	ICRISAT	Direction Agriculture (DA), MDR Niger

Annex 5: List of participants at the workshop on scaling-up of fertilizer micro-dosing technology and warrantage credit system, 20–24 January 2004, Ouahigouya, Burkina Faso.

Name	Country	Organization	Email address
Annou Garba Mallam	NIGER	INRAN	garbaam@intnet.ne
Aboubacar Ousmane Godje	NIGER	DRDA	Tel: (227) 510190
Amadou Bassirou	NIGER	INPUT – FAO project	pintrant@intnet.ne
Camara Sandinan Boubacar	MALI	SG 2000	sg2000@afribone.net.ml
Diall Biraima	MALI	ADAF/Galle	adafgalle@afribone.net.ml
Diallo K. Maimouna	NIGER	ICRISAT, Niamey	m.k.diallo@cgiar.org
Djimadoum Madibaye	BURKINA-FASO	FNGN	fngnagf@fasonet.bf
Konlambigue M. Abdou	TOGO	IFDC-Africa	akonlambigue@ifdc.org
Maatman Arno	TOGO	IFDC-Africa	maatman@ifdc.org
Maikano Ibrahim	NIGER	ICRISAT, Niamey	i.maikano@cgiar.org
Ouedraogo Souleymane	BURKINA-FASO	INERA	ouedsouley@hotmail.com
Oumarou Salissou	NIGER	ONG ABC Ecologie	Tel: (227) 41-02-99
Ousmane Hassane	NIGER	ICRISAT, Niamey	o.hassane@cgiar.org
Palé Siébou	BURKINA-FASO	INERA	palesiebou@hotmail.com
Sako Karamoko	MALI	Winrock International	skaramoko@yahoo.fr
Sigué Hamadé	BURKINA-FASO	INERA	hamade.sigue@laposte.net
Singbéogo Jules	BURKINA-FASO	ADRK	singbeogoj@yahoo.fr
Sogodogo Diakala	MALI	IER	diakalia.sogodogo@ier.ml
Tabo Ramadjita	NIGER	ICRISAT, Niamey	r.tabo@cgiar.org
Taonda Sibiri Jean-Baptiste	BURKINA-FASO	INERA	staonda@hotmail.com
Tapsoba Hamado	BURKINA-FASO	Hunger Project	htapsoba@yahoo.fr



About ICRISAT



The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a nonprofit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Future Harvest Centers of the Consultative Group on International Agricultural Research (CGIAR).

Contact information

**ICRISAT-Patancheru
(Headquarters)**

Patancheru 502 324
Andhra Pradesh, India
Tel +91 40 30713071
Fax +91 40 30713074
icrisat@cgiar.org

Liaison Office

CG Centers Block
NASC Complex
Dev Prakash Shastri Marg
New Delhi 110 012, India
Tel +91 11 25849552/25842553/25841294
Fax +91 11 25841294

ICRISAT-Nairobi

(Regional hub ESA)
PO Box 39063, Nairobi, Kenya
Tel +254 20 7224550
Fax +254 20 7224001
icrisat-nairobi@cgiar.org

ICRISAT-Niamey

(Regional hub WCA)
BP 12404
Niamey, Niger (Via Paris)
Tel +227 722529, 722725
Fax +227 734329
icrisatnc@cgiar.org

ICRISAT-Bamako

BP 320
Bamako, Mali
Tel +223 2223375
Fax +223 2228683
icrisat-w-mali@cgiar.org

ICRISAT-Bulawayo

Matopos Research Station
PO Box 776,
Bulawayo, Zimbabwe
Tel +263 83 8311 to 15
Fax +263 83 8253/8307
icrisatzw@cgiar.org

ICRISAT-Lilongwe

Chitedze Agricultural Research Station
PO Box 1096
Lilongwe, Malawi
Tel +265 1 707297/071/067/057
Fax +265 1 707298
icrisat-malawi@cgiar.org

ICRISAT-Maputo

c/o INIA, Av. das FPLM No 2698
Caixa Postal 1906
Maputo, Mozambique
Tel +258 21 461657
Fax +258 21 461581
icrisatmoz@panintra.com

Vist us at www.icrisat.org