FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Feed the Future USAID Mali Cooperative Agreement Fertilizer Deep Placement and Micro-Dosing Scaling Up Project

FINAL REPORT

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Acronyms and Abbreviations

BNDA	*Banque Nationale de Développement Agricole*
COFRN	Cooperative of Women Rice Farmers in Niena
CRADR	*Centre de Recherche Appui Développement Rural*
CVC	Cereal Value Chain
DAP	Diammonuim Phosphate
DRA	Regional Directorate of Agriculture
FDP	Fertilizer Deep Placement
FDP MD	Feed the Future USAID Mali Fertilizer Deep Placement and Micro-Dosing Scaling Up Project
FTF	Feed the Future
GAP	Good Agricultural Practice
GIE PADS	*Groupement d'intérêt Economique Promotion Agriculture Durable Sikasso*
GIZ	*Gesellschaft für Internationale Zusammenarbeit*
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IER	Institute of Rural Economy
IFDC	International Fertilizer Development Center
IPRO IRRIGAR	*Irrigation de Proximité - Initiative de renforcement de la résilience par l'Irrigation et la Gestion Appropriée des Ressources*
IR	Intermediate Result
ISFM	Integrated Soil Fertility Management
LIP	Local Implementing Partner
M&E	Monitoring and Evaluation
MD	Micro-Dose
MoU	Memorandum of Understanding
NPK	Nitrogen, Phosphorus, and Potassium
NGO	Non-Governmental Organization
PO	Producer Organization
PPP	Public-Private Partnership
RMSV	Rice, Millet, Sorghum, and Vegetable
SONAF	*Société Nama et Fils*
SOPROTRILAD	*Société de Production et de Transformation du Riz dans le Lac Debo*
USAID	United States Agency for International Development
USG	Urea Supergranules
WorldVeg	World Vegetable Center

EXECUTIVE SUMMARY

The Fertilizer Deep Placement and Micro-Dosing Scaling Up Project (FDP MD) was a U.S. government initiative funded by the United States Agency for International Development (USAID). Implemented by IFDC in Feed the Future (FTF) areas, the project aimed to intensify fertilizer deep placement (FDP) and micro-dosing (MD). The objective was to sustainably increase the productivity and production of rice, millet, sorghum, and irrigated vegetable value chains to improve food security and incomes of smallholder farmers and rural agro-entrepreneurs in Mali.

The FDP MD project:

- Covered four regions: Timbuktu, Mopti, Segou, and Sikasso. Technology adoption efforts were intensified through the implementation of appropriate strategies designed to achieve results and impacts beyond the life of the project.
- Duration was five years from 2014 to 2019.
- Covered vegetables, irrigated rice, and lowland rice under FDP in the four regions and dry cereals (millet and sorghum) under MD in Mopti and Sikasso.

The overall goal was to improve the food security and incomes of smallholder farmers and rural agro-entrepreneurs in Mali.

Intermediate Results (IR):

- IR 1: Increased adoption of FDP and MD in the FTF targeted areas of Mopti, Segou, Sikasso, and Timbuktu regions for rice, vegetables, millet, and sorghum.
- IR 2: Increased fertilizer supply and distribution in the FTF targeted areas of Mopti, Segou, Sikasso, and Timbuktu regions, based on private sector needs.
- IR 3: Capacity building of key stakeholders (organized producers, including women and youth, agro-input dealers, research and extension agents, non-governmental organization agents) operating in the targeted areas of Mopti, Segou, Sikasso, and Timbuktu.

The project was organized around the following activities:

- Large-scale dissemination of FDP and MD technologies through the implementation of demonstration trials and FDP (rice and vegetable) diffusion plots in Sikasso, Mopti, Segou, and Timbuktu, and MD in Mopti and Sikasso.
- Capacity building of farmers on FDP MD technologies by farmer leaders in each of the FTF areas.
- Capacity building of briquette manufacturers to produce homogeneous fertilizer samples of correct composition.
- Facilitation of linkages between manufacturers of fertilizer briquettes and agricultural input dealers and producer cooperatives (in Sikasso, Mopti, Timbuktu, and Segou).
- Results-sharing and sensitization of decision-makers through technical meetings and workshops and existing regional or national platforms and forums.
- Mobilization of public and private investments in the process of deploying FDP and MD technologies to match the funds provided by USAID.

This report describes the cumulative achievements under each IR and is organized as follows: Introduction, Implementation Strategy, Project Activities and Results (FDP Rice/Vegetable Technology, MD Millet/Sorghum Technology), Cross-Cutting Issues (Gender, Local Implementing Partners), M&E, Communications, Project Management,) Lessons Learned, Success Factors, Sustainability Factors, Analysis of Main Strengths and Weaknesses of the Project, and Conclusion.

Achievements

Demonstrations

- FDP rice participants: 4,894 producers, including 21% women
- FDP vegetable participants: 698 producers, including 65% women
- MD millet/sorghum participants: 13,448 producers, including 25% women

Guided Tours

- FDP rice participants: 39,330 individuals, including 35% women
- MD millet/sorghum participants: 24,718 individuals, including 28% women

Training

- FDP Fundamentals: 307,526 individuals trained, including 26% women
- MD Fundamentals: 284,865 individuals trained, including 22% women

Technology Adoption

- FDP rice: 90,673 ha of rice area were planted under FDP by 189,647 producers (24% women)
- FDP vegetables: 1,380 ha of vegetable land were planted under FDP by 5,661 producers (62% women)
- MD millet/sorghum: 184,430 ha of millet/sorghum were sown using MD by 176,407 producers (20% women)

Additional Yield

- FDP rice: +2,588 kg/ha
- Lowland rice: +2,043 kg/ha
- MD millet: +730 kg/ha
- MD sorghum: +1,352 kg/ha

Gross Margin (U.S. $ = 528 FCFA)

- FDP irrigated rice: U.S. $1,604 against a target of U.S. $1,600
- FDP rice: U.S. $728 against a target of U.S. $1,600
- MD millet: U.S. $577 against a target of U.S. $260
- MD sorghum: U.S. $397 against a target of U.S. $210

Table 1. Global Achievement by Indicator

USAID FTF FDP MD Objective, Results and Indicators	Baseline	LoP Cumulative Target 2014-2018	Cumulative Achievement to Date	% Global Achievement April 2014 to Date	Indicators Categories
		E	D	F=D/E	
Adoption of Improved Technologies (FDP and MD)					
EG.3.2-18: Number of hectares of rice land under FDP technology or management practices with USG assistance	88	**84,381**	**90,672.64**	**107%**	Feed the Future
EG.3.2-18: Number of vegetable land under FDP technology or management practices with USG assistance (ha)	0	**1,200**	**1,199**	**100%**	Feed the Future
EG.3.2-18: Number of hectares of millet/sorghum land under MD technology or management practices with USG assistance	262	**155,992**	**184,430**	**118%**	Feed the Future
EG.3.2-17: Number of rice farmers and others who have applied FDP technology or management practices with USG assistance (RAA)	0	**156,301**	**189,647**	**121%**	Feed the Future
EG.3.2-17: Number of vegetable farmers and others who have applied FDP technology or management practices with USG assistance (RAA)	0	**4,800**	**5,611**	**117%**	Feed the Future
EG.3.2-17: Number of millet/sorghum farmers and others who have applied MD technology or management practices with USG assistance (RAA) (WOG)	81	**159,018**	**176,407**	**111%**	Feed the Future
Number of FDP-adopting rice producers on farms larger than 2 ha who use granule applicators	0	**1,563**	**1,619**	**104%**	Custom
(EG.3-1) Number of households benefiting directly from USG assistance under Feed the Future	0	**242,267**	**237,943**	**98%**	Feed the Future
GNDR-2 Proportion of female participants in USG-assisted programs designed to increase access to productive economic resources (assets, credit, income, or employment)					Feed the Future
Number of females 10-29 years X	0	**565**	**22,114**	**3,914%**	
Number of females 30 years and over X	0	**360**	**14,769**	**4,102%**	
Denominator Y	0	**1,190**	**139,026**	**11,683%**	
Proportion of women 10-29 years X/Y%	0	**0.95**	**72%**	**76%**	
Proportion of women 30 years and over X/Y%	0	**0.61**	**52%**	**85%**	
EG.11-6: Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance (FDP and technology users)	0	**217,952**	**227,791**	**105%**	Feed the Future

USAID FTF FDP MD Objective, Results and Indicators	Baseline	LoP Cumulative Target 2014-2018	Cumulative Achievement to Date	% Global Achievement April 2014 to Date	Indicators Categories
		E	D	F=D/E	
EG.11-6: Number of people using FDP technology to improve resilience to climate change	0	**116,199**	**115,644**	**100%**	Feed the Future
EG.11-6 Number of people using MD technology to improve resilience to climate change	0	**101,753**	**112,107**	**110%**	Feed the Future
EG.3.2-20: Number of for-profit private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations (CBOs) that applied improved organization-level technologies or management practices with USG assistance	0	**692**	**3,130**	**452%**	Feed the Future
Productivity					
Total quantity of targeted nutritious value chain commodities produced by direct beneficiaries that is set aside for home consumption (custom)	**12,747**	**933**	**408**	**44%**	Custom
EG.3.3-11: TBD3) Total quantity of targeted nutrient-rich value chain vegetable commodities produced by direct beneficiaries with USG assistance that is set aside for home consumption (mt)	11,055	**377**	**226**	**60%**	Feed the Future
Average rice yield increase in fields under FDP (compared to urea broadcasting)	Yield 4 mt/ha	+2,670 kg/ha	+2,588 kg/ha	**97%**	
Average millet yield increase in fields under MD (compared to the farmer practice)	Yield 0.8 mt /ha	**+600 kg/ha**	**+732 kg/ha**	**120%**	
Average sorghum yield increase in fields under MD (compared to the farmer practice)	Yield 0.9 mt /ha	**+1,000 kg/ha**	**+1,352 kg/ha**	**135%**	
Profitability for Farmers					
EG.3.6-7 Farmers' gross margin per hectare of rice under FDP obtained with USG assistance (+$)	$269	+1,600	+1,604	**100%**	Feed the Future
EG.3.6-7 Farmers' gross margin per hectare of millet under MD obtained with USG assistance (+$)	$179	+260	577	**222%**	Feed the Future
EG.3.6-7 Farmers' gross margin per hectare of sorghum under MD obtained with USG assistance (+$)	$183	+210	397	**189%**	Feed the Future.
EG.3.2-19: Value of smallholder incremental sales generated with USG assistance on MD and FDP implementation (+$)	$148,473	28,896,127	**20,082,625**	**69%**	Feed the Future

USAID FTF FDP MD Objective, Results and Indicators	Baseline	LoP Cumulative Target 2014-2018	Cumulative Achievement to Date	% Global Achievement April 2014 to Date	Indicators Categories
		E	D	F=D/E	
Profitability for Input Suppliers					
Total volume of DAP or NPK sold through input supplier as a result of FDP and MD scaling up (mt) (custom)	0	**13,785**	**14,883**	**108%**	Custom
Total volume of urea briquettes sold through input suppliers as a result of FDP scaling out (mt) custom	0	**9,757**	**10,097**	**103%**	Custom
EG.3.2-22: Value of new private sector capital investment in the agriculture sector or food chain leveraged by Feed the Future FDP and MD technology implementation ($) (RAA)	0	**142,000**	**114,872**	**81%**	Feed the Future
EG.3-9: Number of full-time equivalent (FTE) jobs created with USG assistance	0	**1,456**	**350**	**24%**	Feed the Future
Capacity Strengthening					
EG.3.2-1: Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training in FDP Technology	0	**297,257**	**308,682**	**104%**	Feed the Future
EG.3.2-1: Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training in MD Technology	0	**279,755**	**284,865**	**102%**	Feed the Future
Network Development					
Number of private agro-dealers or empowered producer organizations operating a briquetting machine at each FDP site	0	**12**	**17**	**142%**	Custom

I. INTRODUCTION

The Fertilizer Deep Placement and Micro-Dosing Scaling Up (FDP MD) project is funded by the United States Agency for International Development's Mali Mission (USAID/Mali) and implemented by IFDC for large-scale dissemination of two innovative agricultural fertilizer technologies, namely fertilizer deep placement (FDP) on irrigated rice and vegetables and micro-dosing (MD) on millet and sorghum in Mali.

The main goal of the project was to contribute to improving food security and incomes of small rural farmers and agro-entrepreneurs in Mali. As a strategic objective, the project aimed to increase the productivity of cereal crops through the promotion and dissemination of innovative fertilizer-based technologies for targeted commodities (rice, millet, sorghum, and vegetables). Project activities were implemented to achieve three Intermediate Results (IR):

- IR 1: Increased adoption of FDP and MD in the FTF targeted areas of Mopti, Segou, Sikasso, and Timbuktu regions for rice, vegetables, millet, and sorghum.
- IR 2: Increased private sector-driven supply and distribution of fertilizer products in the targeted FTF areas of Mopti, Segou, Sikasso, and Timbuktu regions.
- IR 3: Increased capacity of main stakeholders (organized producers, including women and youth, agro-input dealers, research and extension workers, non-governmental organization [NGO] agents) operating in the targeted areas of Mopti, Segou, Sikasso, and Timbuktu.

From an initial duration of three years, the donor extended the life of the project to five years, following the project's good performance in Years 1 and 2. Its budget increased from U.S. $2 million in 2014 to U.S. $3 million in 2015 and U.S. $6 million in 2016. This extension of the scope of the project over time and in terms of budget also resulted in a spatial extension of the project's intervention areas from Sikasso, Segou, and Mopti to the Timbuktu region; and a widening of the range of agricultural crops to include vegetable crops.

1.1 Results Framework

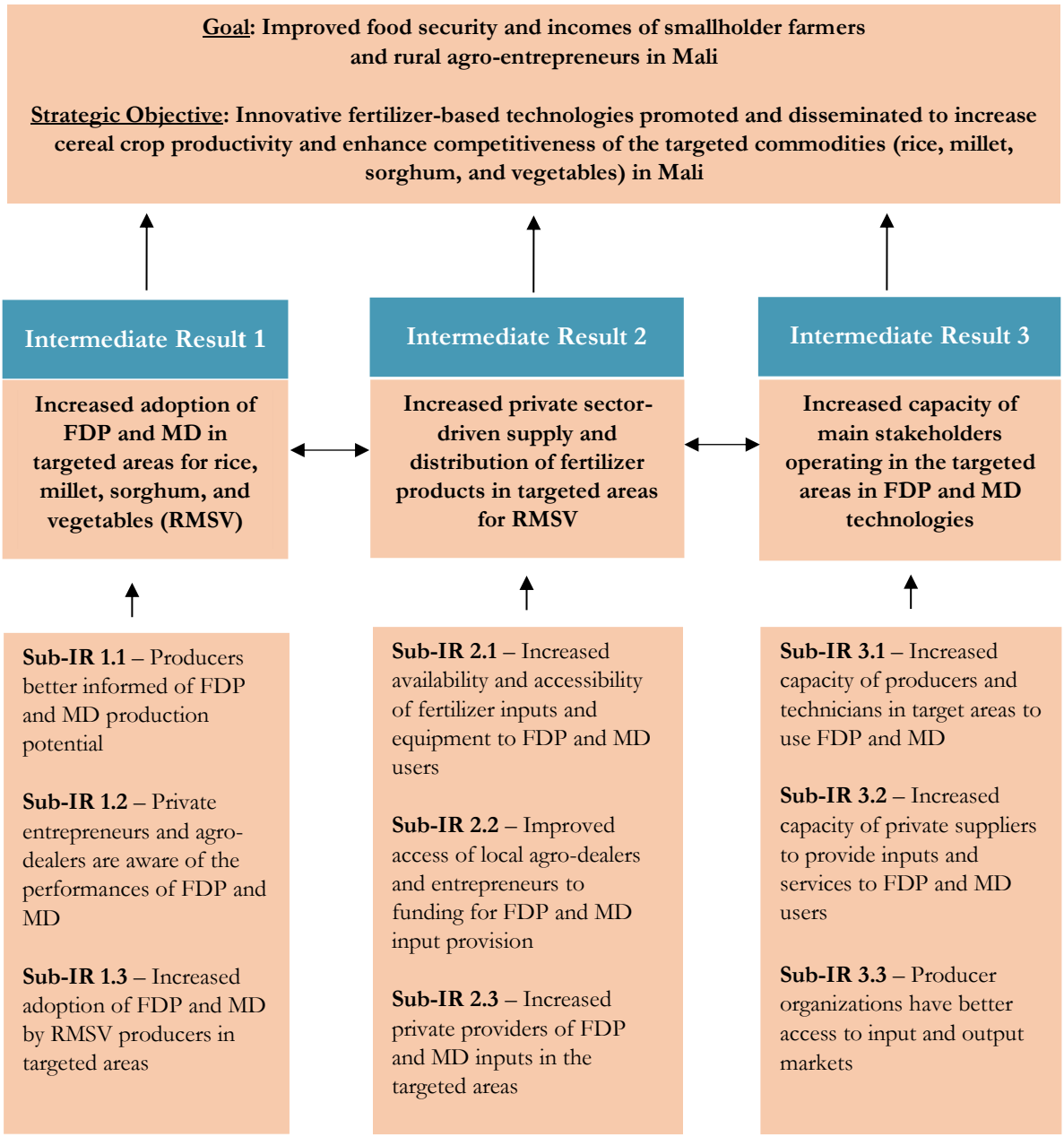


Figure 1. FDP MD Project Results Framework

1.2 Targeted Areas

Targeted areas are the cereal production basins of Mopti, Segou, Sikasso, and Timbuktu regions; all are part of the FTF zone of influence. The choice of communes and villages was determined jointly with the Cereal Value Chain (CVC) project, World Vegetable Center-Mali, and other field partners from the FTF list (Figure 2 and Table 1).

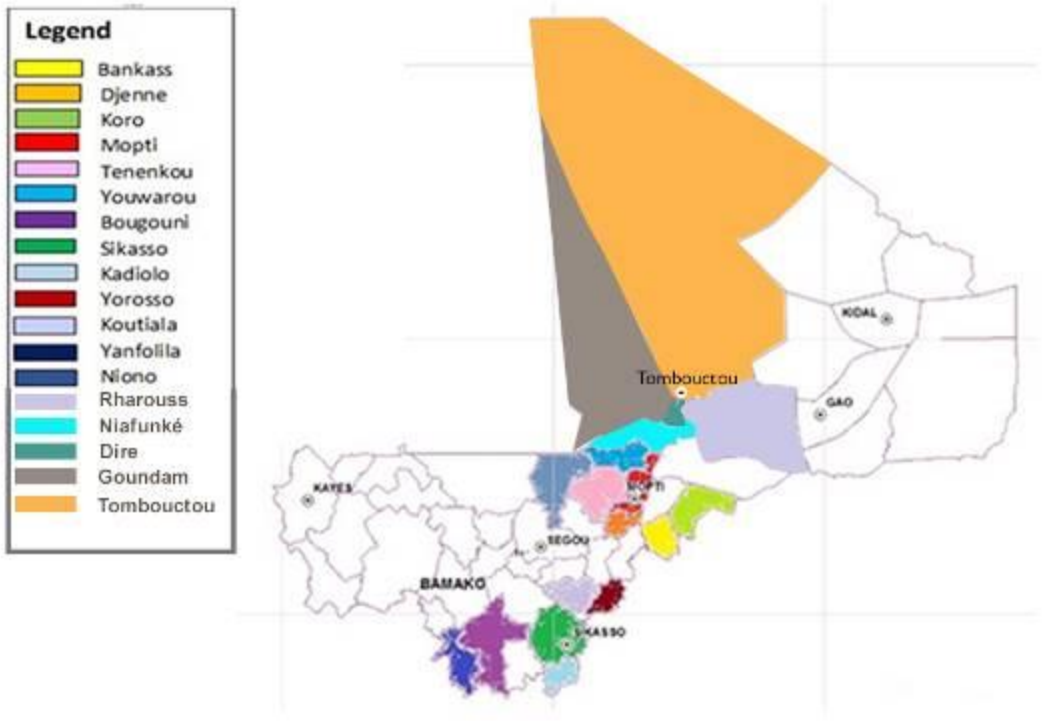


Figure 2. Map of Targeted Regions

Table 2. FDP MD Targeted Communes in FTF Regions and Circles

Regions	Circles	Communes
Sikasso	Yorosso	Yorosso, Karangana
	Koutiala	Koutiala, Koloningue, Kapala, Zebala, Nafanga, Koutiala, Sincina, Ngoutina, Logouana, Sorobasso, Yognogo, Zangasso, Sinkolo
	Sikasso	Sikasso, Kouoro Barrage, Kléla, Fama, Kafouziéla, Gongasso, Miniko, Zanièna, Farakala, Zanferebougou, Pimperna, Natien, Missirikoro, Sokourani-Missirikoro, Kapala, Kaboïla, Kadiolo, Zegoua, Diomaténé, Finkolo, Niéna, Zangaradougou, Loulouni
	Bougouni	Bougouni, Faragouaran, Kouroulamini, Faradièlé, Kola, Kokélé, Zantiébougou, Dèblin, Domba, Sanso, Koumantou
Mopti	Mopti	Mopti, Borondougou, Dialloubé, Konna, Korombana, Kounari, Socoura, Ouromodi
	Djenné	Dandougou Fakala, Kéwa, Djenné, Fakala, Femaye
	Ténenkou	Diafarabé, Diaka, Toguréré-Koumbé, Diondiori
	Bankass	Bankass central, Baye, Dimbale, Kani-Bonzon, Koulogo, Lessagou, Segué, Sobala
	Koro	Koro central, Barapereli, Bondo, Dougoutene 1, Dougoutene 2, Koporona, Koporopin, Pel-Maoudé, Youdiou
Segou	Niono	Dogofry, Diabaly
Timbuktu	Timbuktu	Timbuktu, Bourem Inaly, Alafia, Ber
	Rharous	Rharous, Banikane, Hamzacoma, Séréré
	Goundam	Goundam, Kaneye, Douékire, Tonka
	Niafunké	N'Gorkou, Soumpi, Soboundou, Banikane Narhawa, Koumaïra, Fittouga
	Diré	Sarayamou, Aram, Tienkour Kondi, Bourem Sidi Amar, Gari, Dire, Haibongo, Kirsamba, Garbakoira, Daghan, Tindirma

Source: Compiled by FDP MD project, 2016.

In addition, some communes have been identified by USAID as areas of resilience in the Mopti region. IFDC, similar to other implementing partners, must take resilience into account as a development factor in these areas. Table 2 lists the resilience focus communes in the region of Mopti.

II. IMPLEMENTATION STRATEGY

The main stakeholders of the project included producers, agro-inputs suppliers, rural entrepreneurs, private operators involved in the production and distribution of fertilizers, research and extension institutions, and public technical structures in charge of design and implementation of agricultural policies. Special attention was given to promote the involvement of women in the production of

rice, millet, sorghum, and vegetable farming using FDP and MD technologies in the project intervention areas.

Despite the hostile security conditions in three of the four intervention regions, the project was able to reach or even exceeded targets. These results were achieved thanks to three strategy models used by the project, namely:

- "Faire-Faire" strategy for agricultural extension and advice.
- Public-private partnerships (PPP) for the production and distribution of urea briquettes and other agricultural inputs.
- Strategic partnerships with other projects and programs funded by USAID.

2.1 "Faire-Faire"

The project developed the "Faire-Faire" strategy in the context of extension and agricultural advice. The strategy is based on a protocol that defines the commitments of the stakeholders (IFDC and local implementing partners, or LIPs).

Table 3. List of Key LIPs

Region	Sector		
	Public	Private	Producer Organization/NGO
Sikasso	Regional Directorate of Agriculture of Sikasso (DRA)	Groupement d'intérêt Economique Promotion Agriculture Durable Sikasso (GIE PADS)	
		Centre de Recherche en Appui au Développement de l'Agriculture (CRADR)	
			Coopérative Sénéyiriwa ton de Kiffosso
Mopti	Regional Directorate of Agriculture of Mopti (DRA)		PEENAL
	Office Riz Mopti (ORM)	SOCKAF Sarl	
		Planète Distribution	
			Plateforme Riz Mopti
Segou			Faranfasi so
Timbuktu	Regional Directorate of Agriculture of Timbuktu (DRA)	SOPROTRILAD	

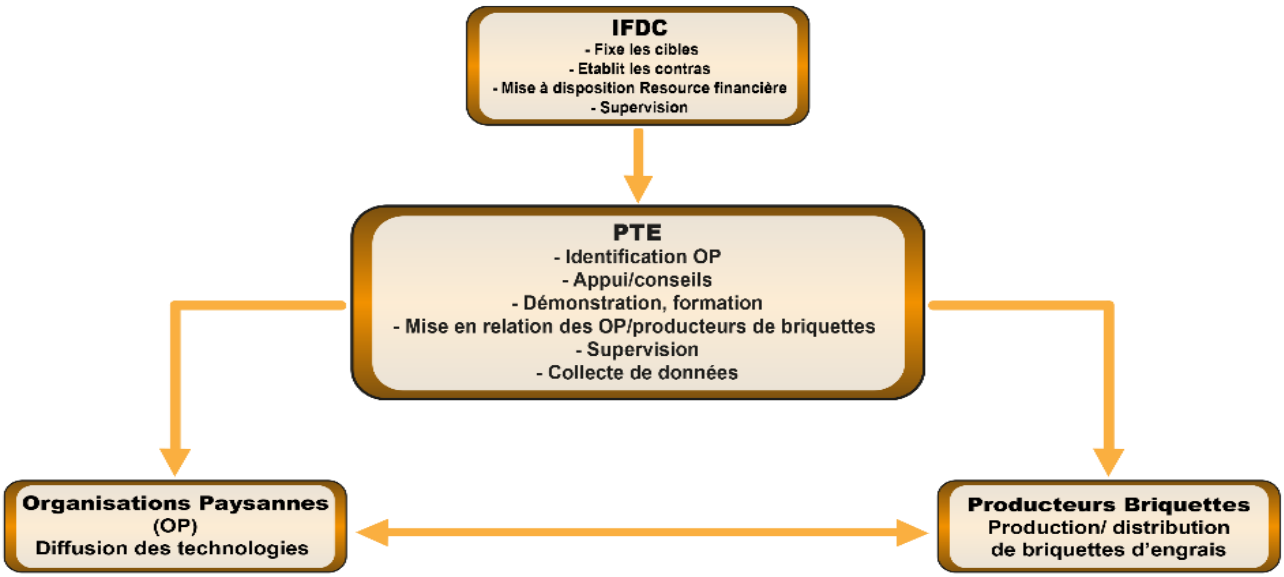


Figure 3. "Faire-Faire" Scheme

2.2 Public-Private Partnership (PPP)

The project developed a public-private partnership with urea briquette production companies. There was no formal protocol signed in this type of collaboration. The project did ensured the importation of briquetting machines purchased by traders for their businesses. A total of 17 briquette machines are currently in Mali and operated by 14 economic operators: three in Sikasso, two in Segou, six in Mopti, and three in Timbuktu.

2.3 Strategic Partnerships

These partnerships were between the implementation structures of USAID-funded projects. They were based on synergy and complementarity in the field. A platform was created by these projects in Mopti where the FDP MD project was very active.

The partnerships were not always accompanied by a formal protocol. However, the project signed two Memoranda of Understanding (MoUs) for specific activities, namely: an IFDC-WorldVeg MoU for research activities on FDP MD in vegetable farming and a four-partner MoU with IFDC, CVC, WorldVeg, and IPRO IRRIGAR for the development of developed perimeters by the IPRO IRRIGAR project in Sikasso.

III. ACTIVITIES AND RESULTS OF THE PROJECT

3.1 Fertilizer Deep Placement (FDP) for Rice and Vegetables

Description

Promoted by IFDC, the FDP in rice cultivation involves placing a compacted urea granule of 1.8 g between 4 rice plants at 7-10 cm depth 7 days after transplanting. Beaded urea is processed into briquettes using a machine called a briquette machine.

As part of vegetable production, a protocol allows the landfill of the urea "supergranule" (briquette) to be planted according to the nutrient requirements of the plant.

Advantages of the FDP

- Increase the efficiency of nitrogen fertilizer use in flooded rice by reducing nitrogen losses due to gaseous emissions and floodwater run-off. With widespread application of urea, volatilization losses alone could account for 30-50% of applied N fertilizers.
- Low concentration of N floodwater promotes biological fixation of nitrogen algae.
- Reduces weed competition because the fertilizer is placed near the rice.
- Encourages better water management and line transplantation (instead of being random).
- Reduces phosphate runoff (P) when urea-DAP is placed deep down.
- Minimize the fixation and immobilization of ammonium and P.
- Reduce the number of inefficient tillers in rice plants.
- Ensure the availability of N until the flowering stage.

A. Status at Project Start

At the start of the project activities in 2014, the FDP was unknown in 03 of the 04 project intervention areas. Only the region of Segou had experienced a pilot project to disseminate the FDP in the largest irrigation system of the Office du Niger in 2009. Other areas (Sikasso, Mopti and Timbuktu) experienced the FDP with the FDP MD project. The supply of urea briquettes was provided by IFDC's pilot project, which had purchased a briquette machine from Bangladesh.

In the intervention areas, producers have relatively easy access to fertilizer through input suppliers. A state subsidy is granted each year to rice producers to boost production. The production system, until now based on the spreading of fertilizer (urea), has always given very low yields with its corollary of loss of fertilizer. A quick analysis of the baseline situation revealed an average yield of irrigated rice of 4 tons/ha in the zones and about 1.2 tons/ha in the lowlands in peasant practice. In 2013, only 24 producers applied the FDP on 88 ha.

The main obstacles to adopting the FDP were that:
- The agronomic and economic potential of FDP technology was not highlighted in the intervention areas for small-scale rural entrepreneurs in rice production and fertilizer distribution.
- Lack of supply of urea briquettes was established.

- Manpower constraints associated with the manual placement of urea briquettes were real.
- The availability of urea briquettes was limited and the available product was too low.
- Lack of training of members of producer organizations on FDP application technique

B. Transformation

To address the challenges posed for the dissemination of the FDP, the project activities were structured into three Intermediate Results (IR) and Sub-Intermediate Results (Sub-IR). Thus, the sections are described as follows: IR 1) Increased adoption of FDP and MD in target areas for rice, millet, sorghum and RMSL vegetables; IR 2) Increased private sector supply and distribution of fertilizer in target areas of the LSMR; IR 3) Enhanced capacity building of key players in FDP and MD target areas.

Each IR has been subdivided into sub-activities to enable rapid achievement of results. Then, the sub-activities of the project in the field of rice and vegetable FDP were described as follows:

- Sub-IR 1.1 - Producers better informed about FDP production potential
- Sub-IR 1.2 - Private entrepreneurs and agro-dealers are aware of the performance of FDP
- Sub-IR 1.3 - Increased adoption of FDP by RMSL producers in target areas
- Sub-IR 2.1 - Increased availability and accessibility of fertilizer inputs and equipment for FDP users
- Sub-IR 2.2 - Increased access for input dealers and local contractors to the financing of FDP and MD input supply
- Sub-IR 2.3 - Increasing private FDP and MD input providers in target areas
- Sub-IR 3.1 - Increased producer and technician capacity in target areas to use FDP and MD
- Sub-IR 3.2 - Increased capacity of private vendors to provide inputs and services to FDP and MD users
- Sub-IR 3.3 - Producer organizations have better access to input and output markets

3.1.1 Increased adoption of FDP in target areas for rice and vegetables RL (IR 1)

One of the first activities that contribute to the adoption of technology is the broad information of the producers on the performance of the FDP. The project has actually carried out several actions in this direction, namely: the conduct of demonstration plots in the countryside, to determine the agronomic and economic performance of the FDP rice and vegetables, the organization of guided tours around these parcels to inform and sensitize other producers and non-rice and vegetable producers on the benefits of the FDP. The project conducted an all-round communication campaign (local TV and radio) around the performance and benefits of the FDP. He produced audio-visual aids such as skits, magazines, leaflets, flyers ... Discussions were organized in his areas of intervention, between the actors (leading producers, local authorities, extension agents) around central themes of the FDP (performance, advantage, constraint, availability of briquettes). The global web has not remained on the sidelines. Indeed, Facebook and tweeter accounts have been opened on behalf of FDP MD to share information (videos, post, photo) on the FDP.

In addition, the radios Local Implementation Partners (LIPs) competition has been very instrumental in the implementation of these actions in the various project areas.

The project organized a national forum on the FDP in Sikasso in February 2015 that brought together public partners already involved in the promotion of the FDP, potential technical and financial partners, agricultural equipment suppliers, private sector partners involved in the commercialization of FDP, agricultural inputs (mainly fertilizer) and representatives of different rice production platforms and rice farmers at national or regional level. This space has effectively served as a framework for sharing with all these actors, not only the performance of the FDP, but also its advantages and constraints.

The project also worked with the Institute of Rural Economy (IER) research for two years for feasibility testing and data validation of the application of FDP rice in lowland ecology in Sikasso. The data from these tests have shown enough, a perfect adaptation of the FDP technology to this ecology. The main recommendation of this ecology is the existence of a 2 cm water slide during the period of August-September so that the FDP can make its effect.

As part of the adoption of the FDP Vegetable, a memorandum was signed between IFDC and World Vegetable Center (WorldVeg) for conducting FDP technology tests on various market garden crops (okra, African eggplant, tomato, onion). These tests also gave satisfactory results.

Interventions

Demonstrations

- 4,894 producers (21% women) participated in the FDP rice demonstrations.
- 698 producers (including 65% women) participated in FDP vegetable demonstrations.

Guided Tours

FDP rice participants: 39,330 individuals, including 13,586 women (35%).

Training

FDP Fundamentals: 307,526 individuals trained, of whom 79,408 were women (26%).

Digitization

231,943 producers (33% of whom were women) in the project intervention areas benefited from capacity building on the fundamentals of FDP and MD technologies through the digitization approach.

FDP Rice Achievement

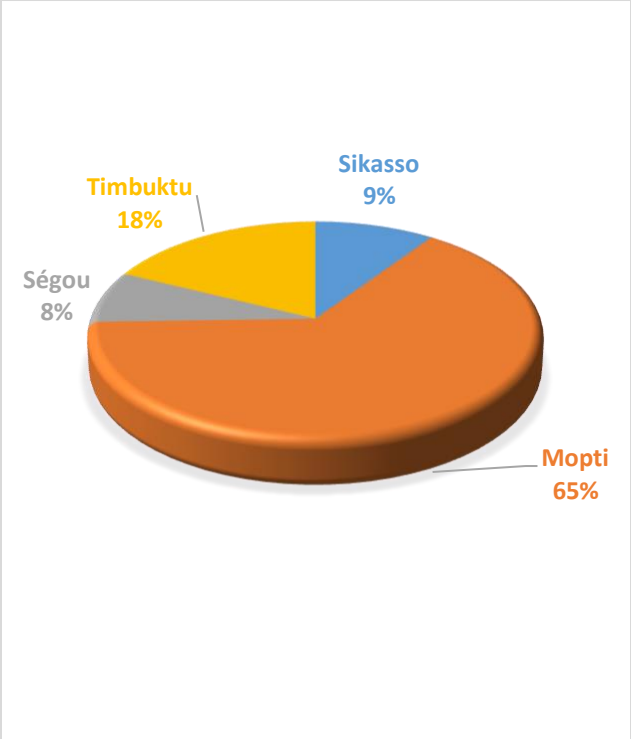
FDP Areas

90,673 ha of rice area were planted under FDP, of which 91% was exploited in total water control (in Segou, Mopti and Tombouctou) and 9% in the lowlands (in Sikasso).

FDP Users

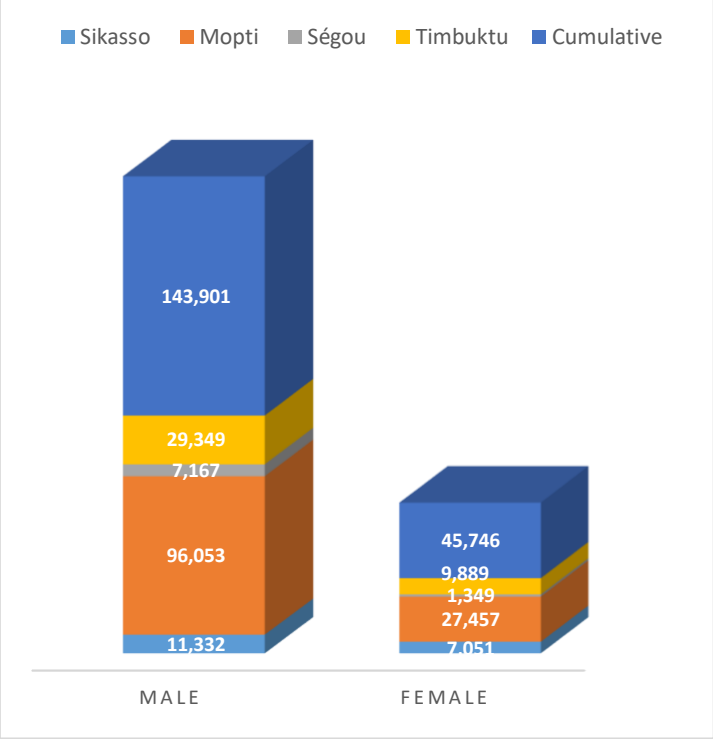
189,647 producers (including 24% women) applied FDP technology in rice production.

The following graphs show the level of application and the distribution of users of FDP technology by region.



Source: FDP MD 2018 survey

Figure 4. FDP Rice Adoption Situation by Region

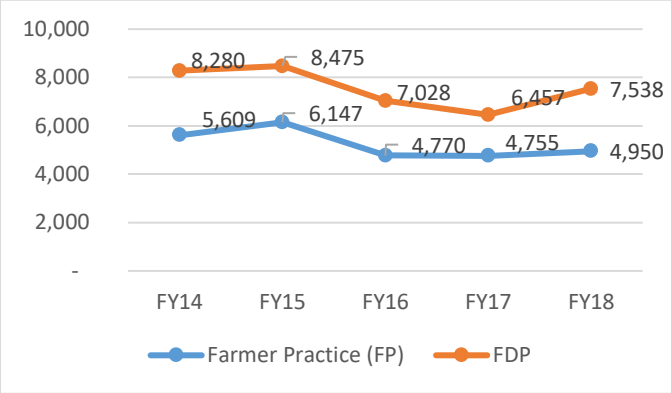


Source: FDP MD 2018 survey

Figure 5 Distribution of FDP Rice Users by Gender and Region

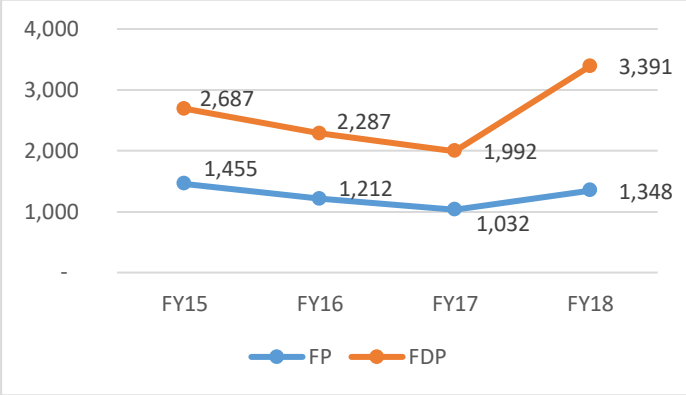
Evolution of Yields under FDP

The rice yields (in irrigated and lowland ecologies) have evolved positively following the good rainfall of the 2017/18 campaign compared to the previous one, which was reluctantly bad in precipitation (see Figures 6 and 7).



Source: FDP MD 2018 survey

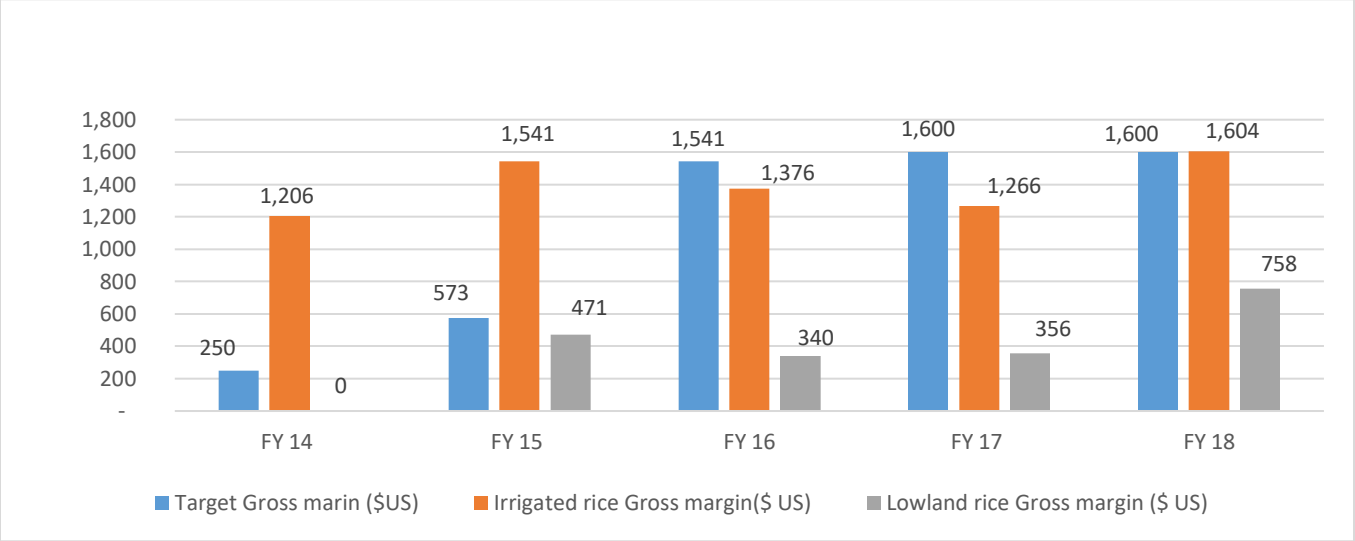
Figure 6. Evolution of Average Yields of Irrigated Rice under FDP Compared to Farmer Practice (FP)



Source: FDP MD 2018 survey

Figure 7. Evolution of Average Yields of Lowland Rice under FDP Compared to Farmer Practice

Figure 8 compares annually the average gross margin of the different ecologies to the annual target.



Source: FDP MD 2018 survey

Figure 8. Evolution of the Average Gross Margin per Hectare of Irrigated Rice and Lowland Rice under FDP Dealers

Box 1. An Innovative Approach to Boost FDP Adoption: The FDP Caravan in Mopti

To boost adoption of FDP technology, which would create market opportunities for private investors who have decided to venture into urea granule production and distribution, a new business in Mali, the USAID FDP MD Project teamed up with three LIPs to organize a FDP caravan around Mopti and Djenne in September 2015. Three private investors from Mopti (Wanfagou, Planet and Karim Sidibe Enterprise) participated in this event with the specific task to provide free promotional briquetting services to attending rice producers.

The caravan approach was based on involving local radio stations for broadcasting information and sensitization messages on urea briquetting three days before the arrival of the FDP caravan. This quickly and widely spread the word around villages and attracted many producers when the trail, including the machine hooked to a cart and the operators' team, arrived in the village. Radio broadcasting of technical messages provided by IFDC and LIP staff on the FDP technology continued while briquetting was taking place.

In summary, this caravan proved to be a real success, as it was a quick tour (just two weeks) of 14 villages, with low-cost provision of focused information and briquetting services. A total of 2,043 bags of ordinary urea were briquetted for 102 tons of super granules, which could be used to fertilize more than 900 ha of FDP rice fields. The machine operation also served as a demonstration as many participants were seeing the briquetting operation for the first time. Participants also got to know first-hand how super granules are obtained and how they can be used to reduce quantities per hectare and increase their production while also protecting the environment.

Photo 1. Dr. Fofana Explains the FDP Technology in the United States. Ambassador during his Visit to the COFRN Demonstration Field in Niéna

Photo 2. National Forum of the FDP Held in Bamako from 10 to 11 May 2016

SUCCESS STORY 1: FERTILIZER DEEP PLACEMENT (FDP) INCREASES LOWLAND RICE YIELDS AND STRENGTHENS SOCIAL COHESION AMONG WOMEN IN KADIOLO

"Since we adopted Bônbôni, our yields have so much increased…many of our women are economically impowered in their expenses. They no longer depend entirely on their husbands. Besides, we are mostly widows." Nabintou OUATTARA

Kadiolo, a small town located in the heart of FOLONA, in Mali. Etymologically, FOLONA means "Plain." With a total area of 29 hectares, which is along the dwellings of the city of Kadiolo, 66 women of the DABAKALA group cultivate this plain for rice cultivation.

Women of DABAKALA are united around a common goal, producing rice for their own consumption.

Photo 3. Women of Dabakala Group Transplanting Rice in Nabintou's Plot

Although the group has existed for decades, women of the cooperative have always worked individually when it comes to farm work. But 3 years ago, everything changed. From individual work to collective work; from very little yields to more sacks of rice; in short, nothing more than progress thanks to FDP, a technology promoted by IFDC through the USAID-funded FDP MD project, which reduces the amount of fertilizer and increases yields.

Photo 4. Nabintou Ouattara Poses with Urea Granule

It all started in 2015. As part of the popularization of this new technology, the local agriculture department, focal point of the USAID-FDPMD project, approached women of the cooperative for the establishment of a demonstration plot. A producer volunteered. Her name is Nabintou Ouattara, a widow of 57 years old. Previously, in her rice plot of less than half a hectare, Nabintou harvested about 675 kg of paddy rice. But with FDP, locally referred to as "Bônbôni", the result of the demonstration was impressive. "*The first year, I only used half of my field for the test. With less seed and less fertilizer, yields far exceeded the other half grown in our traditional way. The following year, all the women adopted this innovative practice. Instead of* 675 kg *in the past, I harvest up to 1725 kg of paddy rice in my small plot of 0.40 ha,"she said.*

Beyond the increase in their agricultural output, fertilizer deep placement has improved social cohesion within the DABAKALA cooperative.

"*Since the advent of Bônbôni, our relations within the association have been strengthened. Transplanting rice in a line form, burying granules, and even weeding, we do everything together,"* confessed Maïmouna Koné, a member of the cooperative.

For the local agricultural service and the Sikasso Regional Directorate, these women have become a reference in the adoption of good agricultural practices (GAPs). Thus, in 2017, the national agricultural mission visited the DABAKALA cooperative in their lowland. This national recognition amplified the adoption of technology throughout the FOLONA agglomeration.

From 2014 to 2018, thanks to the support of USAID, 5,157 women of the Sikasso rice-growing areas, having adopted FDP technology, were able to improve their yields and ensure their financial empowerment. A total of 64, 024 women from the four Feed the Future regions namely Segou, Sikasso, Mopti, and Timbuktu benefited from the USAID FDP MD project.

It is with relaxation and pride that old Nabintou takes delight in the empowerment of FOLONA women following the adoption of FDP: "W*e never thought of selling our crops one day. But since we adopted Bônbôni, our yields have so much increased that we are, now, able to sell some part to cater for our financial needs. Today, many of our women are economically empowered. They no longer depend entirely on their husbands. Besides, we are mostly widows,*" she reveals.

Achievement of FDP Vegetable

Areas

1,380 ha of vegetable land were planted under FDP by 5,661 producers (62% women)

To improve the quality of nutritional intake, the direct beneficiaries of the project produced and consumed with their families:

- African eggplant: 66 tons
- Chili: 26 tons
- Tomatoes: 160 tons
- Onion: 149 tons
- Okra: 215 tons
- Amaranth: 53 tons

Photo 5. Sensitization Session in Niono

SUCCESS STORY 2. FERTILIZER TECHNIQUES INCREASE INCOME AND CROP PRODUCTION IN MALI

Photo: Moussa Koumare/IFDC

Photo 6. Alassane Berthe, an okra farmer from Sanoubougou, Sikasso, Mali

The saying "land does not deceive anyone" has become the motto of Alassane Berthe, a farmer who works on the lush green landscape in Sanoubougou village located in Mali's southern region of Sikasso. While many young people in the region are tempted by urban migration, or work in traditional gold mining sites where they risk their lives, Berthe decided to stay with his family and invest in the land.

In 2016, Berthe received training and support from USAID through the Feed the Future Scaling up Fertilizer Deep Placement and Micro Dosing Technologies in Mali project, which is implemented by the International Fertilizer Development Center.

As a result, he is now considered a resource on the use of the two fertilizer technologies that have reduced production costs by one-third and doubled crop yields.

"Since I started using these agriculture technologies, my production's costs decreased, while my crops increased significantly. People come to buy my okra directly from my farm. Today I don't envy civil servant workers as I have good income," said Berthe, who is 40 years old.

Fertilizer deep placement consists of placing fertilizer briquettes into the soil, near the plant's root zone, which provides the plant with nutrition throughout its growth cycle. This method allows rice and vegetable producers to increase their production and incomes.

Micro dosing consists of applying very small, affordable amounts of fertilizer directly to plant roots. This method increases fertilizer efficiency and can double the productivity of millet and sorghum crops.

For the last three years, the International Fertilizer Development Center trained Malian farmers, including Berthe, in the effective use of the technologies. From 2015 to 2017, the fertilizer deep placement and micro-dose methods increased the production of rice, millet and sorghum for more than 300,000 farmers – 63,000 of whom were women farmers – from Sikasso, Segou, Mopti and Timbuktu regions. Additionally, more than 3,700 producers, including 2,530 women, involved in market gardening started using fertilizer deep placement for okra, eggplant, amaranth, tomato, pepper and onion production.

In his 4,200-square meter plot, Berthe harvested 8,900 kilograms of okra in 2017. He consumed 270 kilograms and sold the surplus, making a profit of $1,400 – a 30% increase in income over what he earned when he previously grew parsley.

Fertilizer deep placement and micro-dosing are also contributing to improved ecosystems and nutrition. Excessive use of fertilizers causes pollution of run-off and groundwater. Because the new methods reduce the amount of fertilizer used, they also reduce nitrate levels in groundwater and surface water. And the increased production of vegetables in the area impacts the nutritional quality of producers' households as well as other households in the community.

Today, many small-scale producers from Berthe's region are inspired by his success, and are now able to increase their income without spoiling the environment by using the new technologies.

"To my fellow farmers, I answer that the use of fertilizer technologies contributed substantially to my success today," said Berthe. "Moreover, with this technology, our market gardening products contribute to improve the nutrition status of our households."

3.1.2 Increasing private-sector supply and distribution of fertilizer in the RMSL target areas (IR 2)

The increased availability and accessibility of inputs and equipment for FDP users are very important aspects in the adoption of the technology. One of the first tasks of the project in ensuring the availability of urea briquettes was to facilitate the importation of briquetting machines from Bangladesh. A total of 17 briquette machines are available in Mali, of which local operators bought 16. 14 briquette companies operate these machines.

Like the briquette machines, the project also imported applicators to meet the application requirements of the FDP. But these applicators have shone by their poor quality. IFDC is working with some structures to mechanize the application of the FDP to boost adoption of the technology.

The project has also worked with briquette companies in the development of an input distribution network for large-scale diffusion of FDP technology. There are two cases: (i) the briquetting company is an input supplier, (ii) the production company is a simple supplier. In the first case, which includes 13 of the 14 briquette companies, each of them has its own input distribution network set up before the project. The production of briquettes is just an addition to the range of services (input credit, equipment credit) already offered to producer organizations (POs) and which has integrated perfectly with the existing network. In the second case, the production company, as a simple provider, has only individual requests to satisfy. Today, the only company (*GIE Dèmeso*, in the region of Mopti) that was in this case, evolved to be depository of fertilizer and suddenly worked directly with POs.

To facilitate producers' access to urea briquettes during peak periods (high demand), the project organized promotional caravans for briquette production. It is an itinerant granulation service (production of urea briquettes) from the applicants to boost the adoption of the technology. The operationalization of this activity was based on cost sharing between the project and the briquette production company.

The creation of a market around the production and distribution of urea briquettes has given the private sector an important interest in adapting their usual financing mechanism to meet the needs of producers. The project linked input Dealers and local FDP input supply contractors, POs with bricklayers and microfinance institutions (MFIs). Many input suppliers have developed financial intermediation strategies to facilitate producer access to inputs.

Achievements

14 briquette production companies including 03 in Sikasso, 02 in Segou, 06 in Mopti and 03 in Timbuktu.

Briquette Machines

17 briquette machines are available in Mali as follows: 03 in Sikasso, 02 in Segou, 06 in Mopti and 06 in Timbuktu.

Private Sector Investment

The private sector has invested close to 65 million FCFA for the purchase of briquette machines, urea briquette applicators and motorcycle pumps for irrigation of rice plots.

Production of Urea Briquettes

More than 10,000 tons of briquettes have been produced in five years by briquette companies.

Revenues Generated by Small Rural Farms

For all crops combined (irrigated rice and lowland rice), producers were able to generate an additional income of more than 16 billion CFA francs.

Box 2. Gender and Rural Entrepreneurship: The COFRN Pioneer Experience in FDP Business

The Cooperative of Women Rice Farmers in Niena (COFRN) comprises 14 women's groups farming 230 ha out of a total of 430 ha in a rice perimeter scheme located in Niena, Sikasso region. To date, COFRN has 512 members, all active in rainfed and lowland rice cropping.

Through activities of the FDP MD project, COFRN was exposed to FDP technology and became interested in promoting it across its organization. Having sensed the business part of this technology promotion, COFRN quickly decided to engage in super granule production and became the only women's organization among the eight pioneer investors in Mali to have acquired a briquetting machine. A 3 million FCFA (loan from BNDA helped buy the machine, while 150,000 FCFA (approximately $250, with $1 = 600 FCFA) from the cooperative funds were used to purchase 10 granule applicators. Seven applicators have been dispatched to some women's groups, and three are reserved for rent services to individual members.

COFRN's ambition to be one of the leaders in FDP business is served by its strategy to create enabling conditions for good performance. First is the development of local capacity to run the business: members have been trained in FDP fundamentals and in applicator use, while further training has targeted machine operators and technical staff. They also collaborated with Teriya, local radio people. Second is the running of the briquetting unit: key leading members including the very dynamic and well-networked president, Roukia Diallo, have been provided with critical advice and information on the efficient management of the machine, while a special five-person management committee led by Mrs. R. Diallo and including the three operators has been set up. Operating procedures have been defined to ensure appropriate documentation of all performed tasks and full recording of all production, costs and revenues.

Having started this season with the production of 11.8 tons of urea granules that generated receipt sales of 413,000 FCFA ($688), COFRN is planning to increase production to 100 tons next year for expected gross sale receipts of 3.5 million FCFA ($5,833). To that end, field agents will be recruited and trained in agribusiness and marketing techniques. Their services will be paid on the basis of briquetting orders they bring in. These field level actions will be reinforced by advertisement on the local Teriya radio and spots on national TV, with the support of the FDP MD project.

Box 3. Promising Involvement of the Private Sector in the FDP/Vegetable Demonstrations

Since its launch, the FDP MD project has put a special emphasis on demonstration activities to show producers the direct effects of the UDP and MD technologies on commodity. Indeed, the installation of the demonstration plots was part of the project activities. But for almost two years, the private sector, mainly the agro-dealer partners of the project, has seen these demonstration activities as a real godsend, hence their motivation to get involved through the supply of inputs. From Sikasso to Timbuktu, via Mopti, partners made themselves heard in this context.

The kick-off was given by SOKAF AGRI LTD, an inputs supplier based in Mopti, which supplied 1.8 kg of seeds for three crops at the beginning of the dry season campaign. The commodity were African eggplant, onion, and amaranth, i.e., 0.6 kg by commodity for vegetable demonstration plots in the Mopti region. This beneficial gesture was followed by three input suppliers who provided a total of 1.45 mt of fertilizer for the FDP vegetable demonstrations in the project intervention areas: the Sènèkèlaw Djigui Sèmèyôrô company in Sikasso, a rice production and processing company in Lake Débo (SOPROTRILAD) in Timbuktu, and Houloulou and Son Company of Timbuktu, which contributed 0.850 mt, 0.5 mt and 0.1 mt of fertilizer, respectively.

The involvement of these input suppliers, partners of the FDP MD project, in the demonstration activities gives assurance that progress will continue beyond the project's close.

SUCCESS STORY 3: SONAF, A LEADING COMPANY IN THE PRODUCTION OF FERTILIZER BRIQUETTES IN SIKASSO IN 2016

Société Nama et Fils (SONAF) is a limited liability company created on November 12, 2010. Its main specialty is marketing (cereals, fruits, vegetables, mahogany nuts, shea nuts, general trade). SONAF has paid CFAF 3,000,000 in cash since 2015 for a briquette machine from Bangladesh. She has since been a partner in the USAID/FDP MD project in the large-scale dissemination of FDP technology on deep-paddy rice and vegetables.

The financial results of SONAF are interesting, for wintering 2016. Indeed, the profits represent more than 90% of the turnover, while the actual cash costs are only less than 10%. SONAF realized a gross profit of 1,884,100 FCFA only in the processing costs of 51 tons of urea in briquettes. This service only lasted two months, from mid-July to mid-September 2016. Its turnover amounted to 2,090,500 FCFA, while its expenses totaled only 206,400 FCFA.

Photo 7. Production of Urea Briquettes

SONAF's client base is diverse and goes beyond the FDP® project. It is currently composed of PO rice farmers and projects supporting the diffusion of the Sikasso EPP technology, namely: the PASSIP/GIZ, various projects of the CRRA Sikasso/IER and various projects of the international NGO Swiss Contact.

The rice producers using briquettes produced by SONAF are mainly located in Sikasso, from 80 POs. SONAF also serves rice producers in nearby Kadiolo, Koutiala and Yorosso circles in briquettes. It should be noted that SONAF has two competing companies in the Sikasso region, based respectively in Niéna (80 km from Sikasso) and Niamala, in Koumantou commune, Bougouni circle.

Photo 8. Machine on the Move

SONAF's partnership with local stakeholders for increasing demand for briquettes is dynamic. Indeed, SONAF collaborates with various local radio stations (08 in the region of Sikasso this year 2016) and 05 local public and private organizations, under contract of the FDP MD project, not to mention the agro dealers, political, administrative and elected leaders who are all dynamic vectors of the messages on the EPP technology.

External technical support to SONAF focuses on agricultural advice, agricultural technologies and equipment, and intermediation. The national NGO CRADR based in Sikasso is the main provider.

SONAF is also a principal partner of SCALE Subregional Project 2 in Sikasso, implemented by IFDC with funding from the Netherlands Embassy. The activities in this context concern support

for the development of the yellow maize value chain. SONAF is a major exporter of yellow maize in the subregion, particularly in Senegal.

3.1.3 Enhanced Capacity Building for Key Stakeholders Involved FDP in Target Areas (IR 3)

Improving the capacity of producers and technicians in the target areas to use the FDP is an essential activity in the adoption of the technology.

The project trained trainers (supervisors and producer leaders) on FDP fundamentals, Integrated Soil Fertility Management (ISFM) and Good Agricultural Practice (GAP). The latter, in turn, trained the producers following the logic of cascade training. Producers also received information on individual protection measures for the use of toxic products. They also received information on the environmental management of project activities as well as the mitigation measures related to activities with negative determination.

The project has also helped to increase the capacity of private providers in providing inputs and services to FDP users. For example, the suppliers received training in the production of fertilizer briquettes, the troubleshooting and maintenance of briquette machines, and the individual safety measures in the production of fertilizer briquettes. A pool of 04 briquetting machines is available in each region and is in contact with the briquette companies.

In addition to technology-related training, briquette companies and agro-dealers have also received capacity building in business management.

Producer organizations have better access to input and output markets through project and non-project (CVC) interventions. The revitalization of partnerships and networking between actors in the rice value chain (CVC) has enabled POs in-kind to input suppliers.

Capacity Building of Master Trainers (extension agents and producer leaders)

1,156 master trainers (23% of whom were women) were trained on the basic principles of FDP rice and vegetables, ISFM and GAPs.

Capacity Building of Briquette Companies

Briquette production, maintenance and maintenance of briquette machines.

Training of Producers and Other Stakeholders

307,526 people (26% women) were trained on the fundamentals of rice FDP, ISFM and GAPs.

Digitization

231,943 producers (33% of whom were women) in the project intervention areas benefited from capacity building on the fundamentals of FDP and MD technologies through the digitization approach

Training Tools

Photo 10. FDP and MD Image Box

Photo 9. Solar Mobile Video Projection Kit

3.2 Micro Dose Millet/Sorghum

Description

Tested by ICRISAT in the Sahelian countries, micro-dose is a technique that consists of putting small amounts (doses) of fertilizer at the foot of the millet and sorghum plant. It allows a more efficient use of fertilizer and helps to significantly increase agricultural yields. In Mali, IFDC recommends a dose of 2 g of DAP/pouch or 6 g of NPK/pouch in a single sowing or emergence application.

Benefits of the Microdose

With the use of MD, the amount of fertilizer needed per hectare is only 20 to 35 kg versus 100 kg for farmers, which is a saving of 75 to 80 percent.

A. Status at Project Start

At the start of project activities in 2014, MD technology was not well known in FTF areas (Sikasso and Mopti). It is true that producers have relatively easy access to fertilizers thanks to the State subsidy and the existence of several operators operating in the fertilizer sector. In Mopti, millet/sorghum producers benefit from the NPK/DAP subsidy for rice producers, which is not the case in other project areas. This discrimination is in favor of Koro and Bankass producers who have only millet and sorghum as the main cash crops and subsistence. A baseline baseline analysis revealed that in 2013, the average yield of millet was 0.8 tons/ha, that of sorghum 0.9 tons/ha in farmers' practice in the project intervention areas.

The main obstacles to the adoption of the FDP were that:

- The agronomic and economic potential of MD technology was not highlighted in the intervention areas for small-scale rural entrepreneurs in rice production and fertilizer distribution.
- Labor constraints associated with the manual implementation of the MD were proven to be real.
- The lack of training of members of producer organizations on the application technique of MD was proven to be real.

B. Transformation

To address the issues raised by the dissemination of MD, the project activities were structured into three Intermediate Outcomes (IR) and Intermediate Outcomes (Under IR). Thus, the sections are described as follows: IR 1 - Increased adoption of FDP and MD in target areas for millet, sorghum and vegetables; IR 2 - Increased private sector supply and distribution of fertilizer in target areas of the MOH; IR 3 - Enhanced capacity building of key players in FDP and MD target areas.

Each IR has been subdivided into sub-activities to enable rapid achievement of results. Then, the sub-activities of the project in the field of micro-dose millet/sorghum and vegetable were described as:

- Sub-IR 1.1 - Producers better informed about MD production potential
- Sub-IR 1.2 - Private entrepreneurs and agro-dealers are aware of MD's performance

- Sub-IR 1.3 - Increased adoption of MDs by mil/sorghum (DM) producers in target areas
- Sub-IR 2.1 - Increased availability and accessibility of fertilizer inputs and equipment for MD users
- Sub-IR 2.2 - improved access for input dealers and local contractors to financing the supply of MD inputs
- Sub-IR 2.3 - Increasing private MD input suppliers in target areas
- Sub-IR 3.1 - Increased capacity of producers and technicians in target areas to use MD
- Sub-IR 3.2 - Increased capacity of private suppliers to provide inputs and services to MD users
- Sub-IR 3.3 - Producer organizations have better access to input and output markets

3.2.1 Increased adoption of MD in target areas for millet, MS sorghum (IR 1)

Information on the production potential of MD is the first activity that contributes to the adoption of technology by producers. The project has indeed carried out several actions in this direction, namely: the conduct of farm demonstration plots, to determine the agronomic and economic performance of MD, the organization of guided tours around these parcels to inform and raise awareness. other producers and non-millet/sorghum producers on the benefits of MD. The project also conducted an all-round communication campaign (local TV and radio) around the performance and benefits of MD. To do this, he produced audio-visual aids (digital and hard) such as sketches, magazines, leaflets, flyers ... The project also organized in the regions, debates between the actors (leading producers, authorities local, extension agents) around the central themes of MD. The canvas was also used to scale information on the MD (Facebook, tweeter).

The project's use of motivated and competent public and private Technical Implementation Partners services has led to interesting results in the different areas of intervention.

The project organized a national forum on the FDP and MD in Sikasso in February 2015 which brought together the public partners already involved in the promotion of the MD, the potential technical and financial partners, the agricultural equipment suppliers, the private sector partners and involved in the marketing of agricultural inputs (especially fertilizer). This space has effectively served as a framework for sharing with all the actors, not only the performance of the MD, but also its advantages and constraints.

Interventions

Demonstrations

13,448 producers (25% of whom were women) participated in MD millet/sorghum demonstrations.

Guided Tours

24,718 people (including 28% women) participated in guided tours around MD millet/sorghum demonstration plots.

Training

284,865 people were trained (including 22% women) on the fundamentals of MD.

Digitizing

231,943 producers (33% of whom were women) in the project intervention areas benefited from capacity building on the fundamentals of FDP and MD technologies through the digitization approach.

Achievement Adoption MD Millet/Sorghum

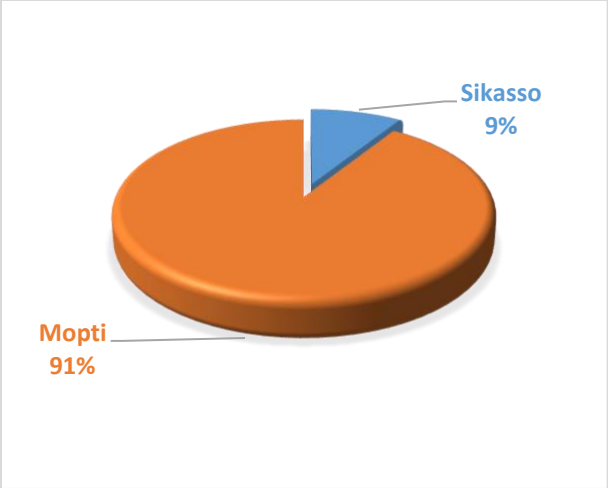
Areas

184,430 ha of millet/sorghum were planted under MD, of which 91% was harvested in Mopti and 9% in Sikasso.

MD Users

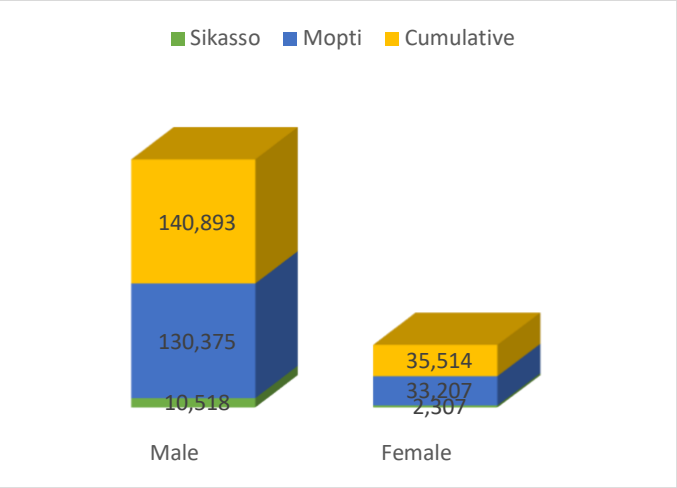
176,407 producers (including 20% women) applied MD technology in millet/sorghum production.

The graphs below show the level of application and the distribution of MD technology users by region.



Source: Sondage FDP MD 2018

Figure 9. Situation of MD/Sorghum Adoption Acreage by Region

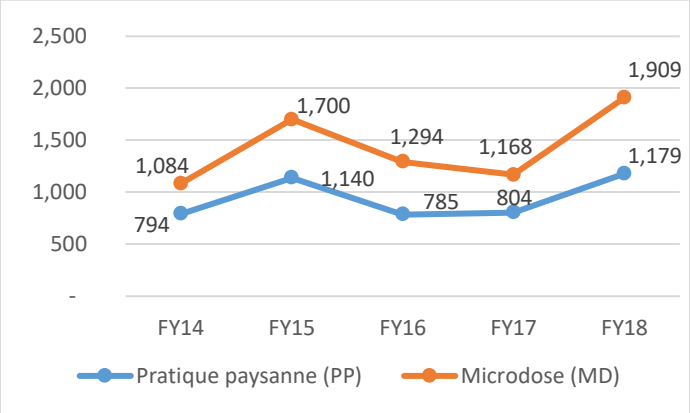


Source: Sondage FDP MD 2018

Figure 10. Distribution of MD Millet/Sorghum Users by Gender and Region

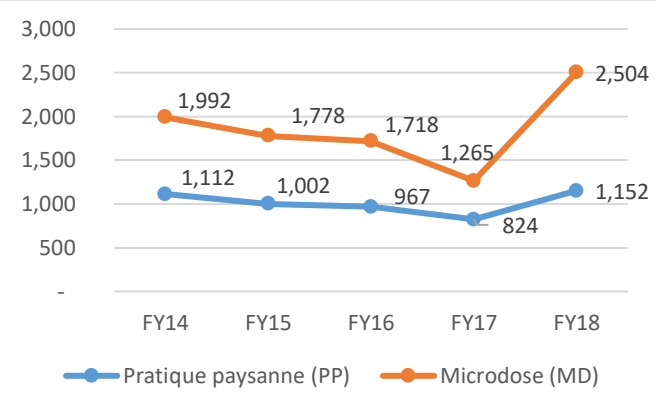
Evolution of Yields under MD

The yields of millet/sorghum have evolved positively following the good rainfall of the 2017/18 campaign compared to the previous one, which was reluctantly bad in precipitation. This explains the peaks of FY18 (Figures 11 and 12).



Source: FDP MD 2018 Survey

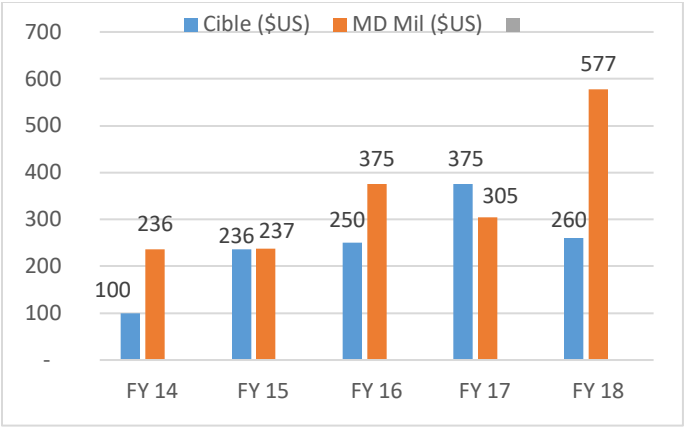
Figure 11. Evolution of Average Yields of Millet under MD Compared to FP



Source: FDP MD 2018 Survey

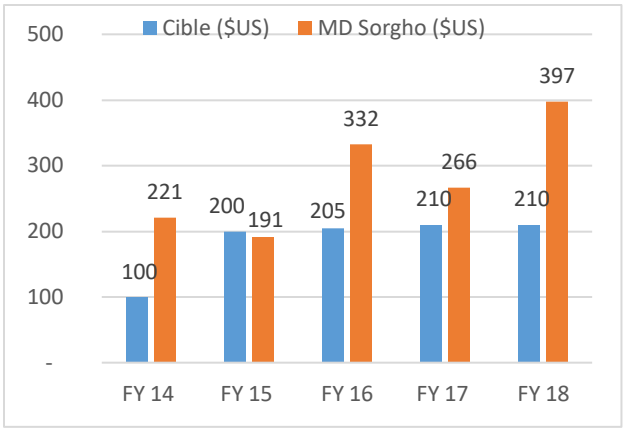
Figure 12. Evolution of Average Yields of MD Sorghum Compared to FP

The chart below compares annually the average gross margin of millet and sorghum crops to annual targets out of five in the project.



Source: FDP MD 2018 Survey

Figure 14. Evolution of the Average Gross Margin per Hectare of Millet under MD



Source: FDP MD 2018 Survey

Figure 13. Evolution of the Average Gross Margin per Hectare of Sorghum under MD

Box 4. Malian Government Reduced Funding for Subsidy through Microdosing in Mopti

In April 2014, the International Fertilizer Development Center (IFDC) arrived in the Mopti region with the USAID-funded FDP MD project to disseminate a fertilizer technology called Micro Dose to increase yield of millet crops and sorghum. This technology has proven to be a good agricultural practice because it uses 35 kg per ha against 100 kg per ha recommended by the vugarization structure. Hence the motivation of the National Directorate of Agriculture to recommend MD technoto all producers of millet and sorghum to apply it in order to benefit from the public subsidy. Therefore, this adoption has greatly helped the Government of Mali to reduce the amount of money planned for the fertilizer subsidy component.
From 2014 to the present, with the support of USAID, 117,115 people were cultivated under Micro Dose by 112,115 people, of which 12,505 women farmed 19,688 hectares.

On this basis, the amount of subsidized fertilizer was reduced from 11,780 tons to 4,123 tons in the Mopti region. Either a fertilizer saving of 7,657 tons.

SUCCESS STORY 4: MICRO DOSE TECHNOLOGY CHANGES THE LIVES OF PRODUCERS IN BANKASS, MALI

The village of Bankass in the Mopti region of Mali was once known for its excellent millet and sorghum production. Nowadays, however, the impact of weather fluctuations is felt throughout the country, especially in areas like Bankass with low rainfall and weak soil.

Photo 11. Mamoudou OUEDRAOGO Poses in His Millet Plot

Thirty-three-year-old Mamoudou Ouedrago is married to two women and is the father of five children. He teaches the Quran to village children and, during the agricultural season, works on his 6-hectare farm where he grows millet and sorghum.

In the past, after the harvest season, Ouedrago would move to the city to find a job since he could not support his family with farming only. He lived away from his family for six or seven months of the year.

In April 2014, USAID's Feed the Future Scaling up Fertilizer Deep Placement and Micro Dosing Technologies in Mali project began operating in Mopti, Segou, Sikasso and Timbuktu regions.

"When the farmers were recommended for the first time to use *kèmèkunu* [micro-dose in the Dogon language], they had concerns on its efficiency. As it was something quite new to me, I tried it, but in a small plot. When the harvest time arrived, I got more than expected. Today, I apply this technology in the whole field," said Ouedrago.

Micro dosing consists of applying very small, affordable amounts of fertilizer directly to plant roots. This method increases fertilizer efficiency and can double the productivity of millet and sorghum crops. The increased production of vegetables in the area impacts the nutritional quality of producers' households as well as other households in the community.

The new method also protects valuable ecosystems. Excessive use of fertilizers causes pollution of run-off and groundwater. Because micro-dosing reduces the amount of fertilizer used, it helps to decrease nitrate levels in groundwater and surface water.

The micro-dose technology was so successful in the targeted regions that the National Directorate of Agriculture recommended that all millet and sorghum farmers apply it. Since 2014, more than 112,000 farmers, of whom 12,500 are women, have cultivated nearly 118,000 hectares using the technology.

While the technology improved resource-poor farmers' access to quality and nutritious food in Mali, it also helped the government to reduce fertilizer subsidies. Since 2014, subsidized fertilizer has decreased from nearly 11.8 million tons to 4.1 tons — a savings of 7.7 tons.

Ouedrago previously harvested only 0.7 tons of crops per hectare on his millet and sorghum farm. Now, with the micro-dose technology, he can harvest up to 1.2 tons per hectare. He also saves significantly on investment in fertilizer and seed. He shares his experience with producers in surrounding villages.

"Since I began using micro-dose technology, I have not bought any cereal till now," said Ouedrago. "Every Friday, I visit the producers of neighboring villages to let them know about the benefits of the micro-dose."

3.2.2 *Increased Private Sector Fertilizer Supply and Distribution in MS Target Areas (IR 2):*

The project has been instrumental in increasing the availability and accessibility of fertilizer inputs for MD users. To ensure the availability of DAP/NPK, the project relied heavily on subsidized fertilizer in Mopti. In fact, in its distribution strategy for fertilizer subsidy, the Regional Directorate of Agriculture of Mopti took the initiative to distribute the individual deposit on the basis of the MD standard per hectare. This has allowed several producers in the Koro/Bankass localities (Mopti region) to access fertilizer (NPK/DAP) for MD. Otherwise, the MD will be adopted because the producers are already appropriate himself of the technology and it perfectly meets their needs.

The project also worked with input suppliers in the development of an input distribution network for large-scale dissemination of MD technology. Each input supplier has its own input distribution network set up before the project.

For better access for input dealers and local entrepreneurs to finance the supply of MD inputs, the project linked FOs with urea briquettes producers and microfinance institutions (MFIs). Many input suppliers have developed financial intermediation strategies to facilitate producer access to inputs.

Although access to fertilizer is solved, the application of MD remains a constraint because it also requires labor. Certainly, some technologies (cane planters) are available but need to be popularized. IFDC is working with some structures to mechanize the application of MD to boost adoption of the technology.

The project worked to increase private MD input suppliers in target areas. The project worked with SOPROTRILAD, Toguna SA, Ar-in-Sky, Nyumani SA, Salaha Touré Company; operate in the project areas as fertilizer suppliers for MD.

Achievements

Quantity of DAP/NPK Sold

More than 14,000 tonnes of DAP/NPK have been sold by input suppliers for the deployment of FDP and MD technologies in all project areas.

Revenues Generated by Small Rural Farms

For all crops combined (millet and sorghum), producers were able to generate an additional income accumulation of around CFAF 4 billion.

3.2.3 Enhanced Capacity Building for Key Stakeholders Involved in MD Technology Target Areas (IR 3)

The project contributed to increasing the capacity of the producers and technicians on the use of MD for large-scale deployment in the project targeted areas.

The project trained trainers (supervisors and producer leaders) on the fundamentals of MD, ISFM, and GAPs. The latter, in turn, trained the producers following the logic of cascade training. Producers also received information on individual protection measures for the use of toxic products. They also received information on the environmental management of project activities as well as the mitigation measures related to activities with negative determination.

The project has also helped to increase the capacity of private providers in providing inputs and services to MD users.

Producer organizations have better access to input and product markets through project intervention. The revitalization of partnerships and networking between actors in the millet/sorghum value chain (CVC) has made it possible for group or individually problem-free belly POs.

Achievements

Capacity Building of Master Trainers (extension agents and producer leaders)

1,156 master trainers (23% of whom were women) were trained on the basic principles of MD millet/sorghum, ISFM and GAPs.

Training of Producers and Other Stakeholders

284,865 people (22% women) were trained on the fundamentals of MD, ISFM and GAPs.

Digitization

231,943 producers (33% of whom were women) in the project intervention areas benefited from capacity building on the fundamentals of FDP and MD technologies through the digitization approach.

SUCCESS STORY. DIGITIZATION AS AN INNOVATIVE ALTERNATIVE TO TRADITIONAL DEMONSTRATIONS AND FIELD-GUIDED TOURS

Photo 12. Digitization session in Kiffosso, Sikasso

"We farmers, we prefer to see once than to hear a thousand times. Most interestingly, producers like us are talking in these videos, showing what they have been able to achieve through these technologies." Bakary Traoré, Farmer in Nimbougou, Sikasso.

The Scaling Up Fertilizer Deep Placement and Micro-Dosing (FDP MD) project is funded by the United States Agency for International Development's Mali Mission (USAID/Mali) with the purpose to provide support for

scaling up two fertilizer-based technologies, namely FDP on rice and vegetables, and MD on millet and sorghum, in Mali. The program focuses on the country's Feed the Future (FTF) zone of influence, specifically the regions of Segou, Mopti, Sikasso, and Timbuktu.

During its first two years, the FDP MD project focused on the dissemination of the Urea Deep Placement (UDP) and Micro Dose (MD) technologies using classical demonstration and guided tours activities – that is the setting up and touring of many demonstration plots in the various intervention sites. This method was certainly effective, but it proved costly, slow for adoption, poorly mobilized women and young people and required a lot of effort in monitoring and coaching.

In light of this observation, the project then considered the implementation of the "digitization" method from the 2016-2017 crop year in its intervention areas across the regions of Sikasso, Segou, Mopti, and Timbuktu.

Digitization is an innovative ICT-based activity developed by the project to achieve several objectives, but mainly to quickly reach many targets in the intervention areas within a shorter time period. It consists of:

i. Producing films using images of a real field-guided tour of a demonstration plot with testimonies of direct actors who have already applied these technologies and know perfectly the different stages of their application as well as their advantages.

ii. Creating short animation videos on benefits and application techniques to facilitate understanding in different national languages.

These films are then converted into several video formats (MP4, 3GP, and MP3) to enable their broadcasting on all media (i.e., TVs, computers, mobile phones, tablets and radios) and dubbed in eight (8) national languages. They are transferred on Pen drives, CDs, shared on smartphones; and broadcasted during producer and LIPs meetings or during cascade trainings among farmers.

Photo 13. Bakary Traoré watching video on mobile phone with an extension officer.

Compared to the conventional or classical demonstration approach, digitization has lot of advantages among which:

- Lower per unit cost: in 2017-2018, a total of U.S. $11,513.98 was spent in the organization of guided tours that attracted 1,233 individuals versus U.S. $19,853.22 spent on digitization to reach 10,184 individuals. Hence, it comes down to spending about U.S. $1.95 per individual with the digitization method versus U.S. $9.34 per individual with the guided tour method. The material used under digitization is provided free of charge by the population.

- Quickly reached targets:
  - FDP: in 2017-2018, 7,569 individuals (including 2,726 women) have been reached by digitization versus 923 individuals (including 287 women) by the traditional guided tour.
  - MD: 2,615 individuals (including 701 women) have been reached by digitization versus 310 individuals (including 113 women) by the traditional guided tour.
- Shorter Time: digitization can be done at any time and takes only half an hour to implement compared to five hours under the traditional method.
- Increased Participation: greater level of women and young people's participation in project activities, because the space of digitization is always installed in the village near the population, which facilitates the access by these vulnerable groups to information about technologies FDP and MD.
- Availability of videos with producers at any time.

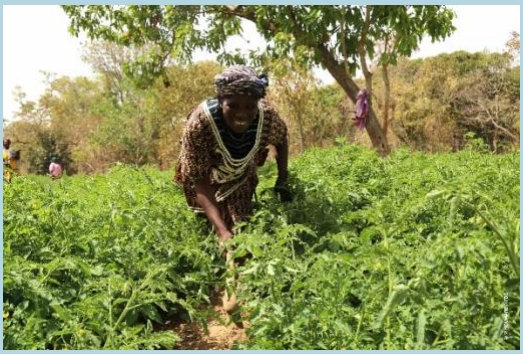
In 2018, 1,156 farmers' leaders and secretaries of farmer-based organizations (FBOs) were trained on digitization. This made it possible to train 231,943 producers in the different intervention areas of the project. Bakary Traoré, farmer in Nimbougou in the Sikasso region and beneficiary of a digitization training argued: "*in just a short period of time, we have learned everything on these technologies namely application techniques and advantages. We farmers, we prefer to see once than to hear a thousand times. Most interestingly, producers like us are talking in these videos, showing what they have been able to achieve through these technologies.*"

IV. CROSS CUTTING ISSUES

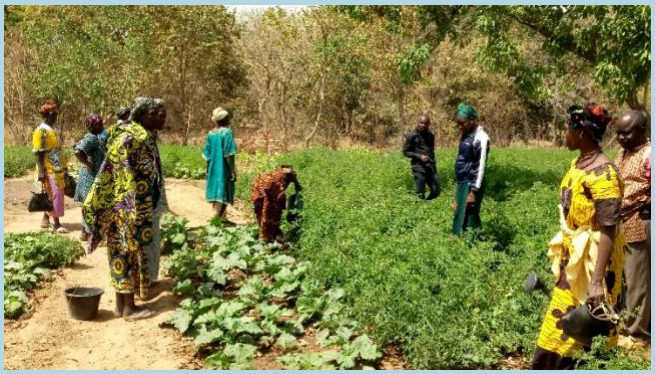
A. Gender

The FDP MD project has worked a lot in the context of women's involvement in activities. Gender disaggregation of all project indicators is established in the PMP. However, the high quotas set for women for certain indicators such as areas of adoption are not always easy to achieve because women's access to land is very difficult. Indeed, the project has used two levers to improve the participation level of women in the activities. The first lever to improve the involvement of women in the field was support for activities promoting women's participation (). At this level, of the 5,661 market gardeners with whom the project worked, 62% are women. The second lever is capacity building, especially through the digitization approach, the project was able to reach 26% of women trained out of a total of 307,534 people trained in the short term on the productivity and fundamentals of the FDP. The same approach has reached 22% of women trained in the 284,865 people trained on productivity and MD fundamentals.

Box 5. The FDP Improves the Nutritional Quality and Income of Market Women in Korowédougou



Korowédougou, a village located 45 km from Sikasso, the 110 women Benkadi cooperative have been able to improve the nutritional quality in the village through the adoption of (FDP. A boon for these women who produce not only for their own consumption, but also for sale. "I'm happy; because I'm going to have a lot of tomatoes this year. The increase in the quantity of our productions will strongly contribute to the fall in market prices, because we sell these productions among ourselves. Everything that is grown here is consumed in our families," says Naminata Foyon Diarra, a member of the cooperative.



From production to consumption, the women of the cooperative are aware of the benefits of their labor; because they are the first beneficiaries of sales revenue

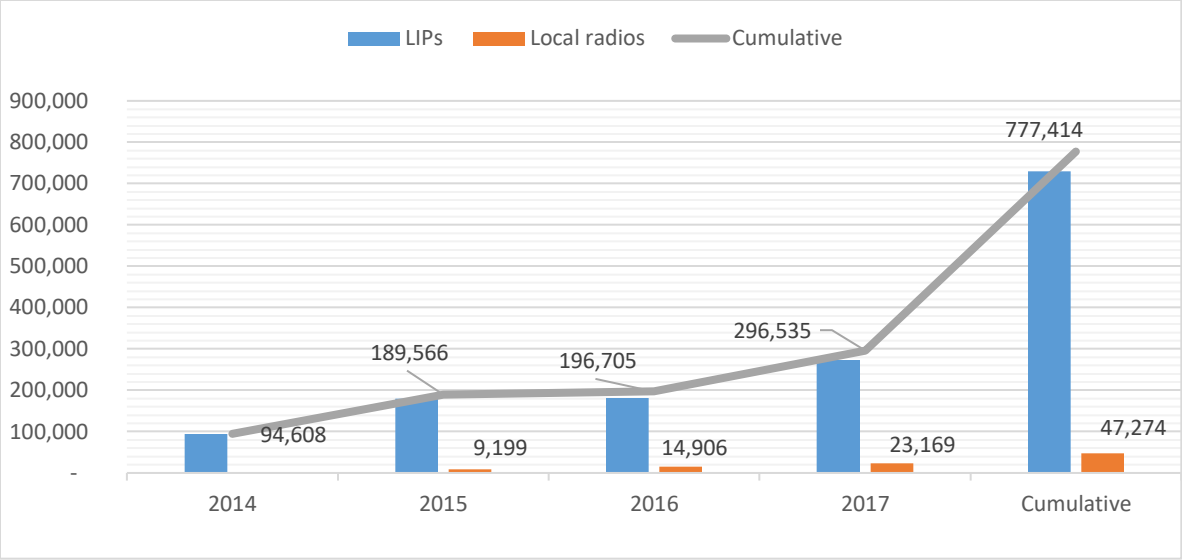
B. Support to LIPs

The LIP is the main actor in the implementation of the project activities following IFDC's Faire-Faire Strategy. Each year, the LIPs were selected on the basis of the application file. The partnership was still formalized by a contract signed between LIPs and IFDC. The contract defined the commitments and responsibilities of both parties and the budget was financed by the project funds.

The project had to work in 2014 with 06 LIPs, in 2015 with 07 PTE, in 2016 with 13 LIPs and in 2017 with 13 LIPs. In total, the project injected FCFA 428.6 million (U.S. $740,130) into the contracts with the LIPs.

In addition, as part of the communication, contracts were signed between IFDC and local radio stations. These contracts cost a total of 27.7 million FCFA (47,274).

Figure 15 below gives the annual details.



Source: FDP MD 2018 Survey

Figure 15.

C. Monitoring and Evaluation

The M&E unit has been very active throughout the FDP MD project implementation phase. She has updated the documents annually:

- The project performance monitoring plan.
- The work plan.
- the monitoring manual.
- The plan for monitoring and mitigating project impacts.

The unit proceeded with the operationalization of the monitoring and evaluation mechanism of the project through:

- Training of TEPs on the monitoring mechanism (data collection, verification, validation and feedback) and management of environmental impacts.
- Preparation of the documentation necessary for the exercise of external and internal Data Quality Assessment.
- Conducting all assessment and studies of the project.
- The preparation of the project withdrawal and closure plan.

The unit assured:

- Management of the project database.
- The centralization of original collection forms.
- Evaluation of agronomic and economic performance of FDP and MD technologies.
- The quarterly and annual report.
- The implementation of baseline and impact studies of the project.

D. Communication and Awareness

The communication unit was entrusted to a communication specialist. She was responsible for the development and implementation of the project communication plan. Among other responsibilities, she assured:

- Respect for USAID and IFDC Branding.
- The visibility of the two structures;
- The production and use of communication tools.
- The production and distribution of magazines and skits on TV.
- Scaling of project information on social networks. The content of the project's activities and achievements was continuously posted on Facebook, Twitter, Flickr and YouTube to widely disseminate information on FDP® technologies.

Photo 14. Session of Data Quality Assessment Conducted in Sikasso. From right to left: Mrs. Maïmouna Ballo, field agent; Mr. Seydou Cissé, PADS director; and Dr. Diagana Bocar, IFDC

Box 6. Role of Social Networks in the Promotion of FDP and MD Technologies

Since April 2016, the FDP MD project has given pride of place to social networks in its communication strategy. Given the role that these platforms play in the life of organizations, the project has made this channel an essential means to increase its own visibility and that of its partners. The creation of Facebook, Twitter, Flickr and YouTube pages has made it possible to widely disseminate information on FDP MD technologies to a diversified target. In just 2 years, many people between the age of 18 and 65 years followed project's pages. Nowadays more than 113 subscribers follow the YouTube page with more than 19,631 views. Facebook page is followed by more than 1,256 subscribers, of which 15% are women. A total of 1,228 photos of the project's activities and beneficiaries are published on Flickr page; 41 tweets, 26 subscribers and 95 likes on Twitter page.

In order to increase the project visibility and share information on both technologies, project's social networking pages are continually updated and reinforced with graphical and visual data.

SUCCESS STORY 5: COMMUNICATION, A POWERFUL TOOL IN THE DISSEMINATION OF FDP AND MD TECHNOLOGIES

The FDP MD project focused on the dissemination of FDP and MD technologies on IFDC's traditional method in the field. To achieve its goal of adopting both technologies, the project must set up numerous demonstration plots in different areas of intervention.

Many rice, millet and sorghum producers have followed the evolution of these model plots in real time. Some of these demonstration plots were selected to organize guided tours for producers, local radio stations, policy makers and various support services to the agri-food industry. The method proved to be effective, but it seemed costly, slow to adopt and poorly mobilized for women and young people.

In order to raise awareness of the project and its objectives, FDP MD staff used audiovisual coverage of key project activities through the Office of Radio and Television Mali (ORTM), which produced and broadcast television and radio productions. Following positive feedback from field partners on the high success rate of television and radio programs, the project decided to engage a communications specialist to coordinate all communication activities and optimize the results of the project.

It has developed a clear and concise communication plan that defines the overall strategy to reach diverse audiences through various communication activities, including:

- TV broadcast of magazines, sketches and information on FDP and MD technologies in different languages (French, Bambara, Sonhrai).
- Magazines broadcasting, radio debates, interviews, radio messages in seven local languages on FDP and MD technologies.
- An illustrative box is created to help implementing technical partners communicate with farmers and more effectively communicate technology-related awareness messages.
- Capturing images of FDP and MD practices throughout the crop year to produce documentaries
- Launch of the project's social media networks (Facebook, Twitter Flickr and YouTube).

For the effective implementation of the communication campaign, the project signs partnership agreements with 25 radio stations in its areas of intervention, responsible for conducting local communication activities on FDP and MD technologies.

"I would like to speak to my radio colleagues so that they realize that the activities of this project contribute to improving the living conditions of our farmers. Regardless of any financial reward, we must commit to continually promoting micro-dosing technology for the well-being of our communities. The project will probably end in a day, but the medical director should continue in all our fields of millet and sorghum. Seydou Arey Guindo, director of programs at Bankass Seno Radio, Mopti.

These various communication activities make it possible to inform people everywhere in Mali about FDP and MD technologies. Thus, after the intensive broadcast of FDP and MD skits on television in June and July 2016, COFRN, a farmers' organization based in Niena, declared that it had received a strong demand for Bamako granules and surrounding areas (Baguineda and Ouelessebougou).).

In addition, the communication campaign has convinced many private investors to invest in the production activity of the U.S. government. Thus, two heavy agricultural inputs in Mopti, Toguna Agro Industries and Rainbow and a private investor in a private investor, Moctar Nientao, each acquired a unit of urea briquette production machine. In Timbuktu, private investors are also facing fierce competition to position themselves in the region's market. The company Houloulou Ag Mohamed has acquired 3 units, SOPROTRILAD 2 units and Salaha Touré 2 units.

> *"I heard radio broadcasts on Microdosing on Kénédougou radio in Sikasso. A few days later, I followed a skit that spoke about it on national television. Technology interested me a lot but I did not know how to access detailed information. One day, PADS officers came to our village and introduced the technology at a meeting. I then took the opportunity to understand more about it and decided to apply to 6 hectares of millet."*
>
> —Hamidou Traoré, farmer in Kogodeni, Sikasso region.

This enthusiasm for FDP technology demonstrates the importance of its penetration into the Timbuktu region through all communication efforts.

Photo 15. TV Sketching Session on FDP

Photo 16. Short FDP Application Session

In order to increase the visibility of the project and to share information on both technologies, the social network pages of the project are continually updated and reinforced with graphic and visual data.

Communication Tools

Photo 17. Communication Tools

E. Project Management

Table 4. Challenges

Project Management	Challenges Covered	Challenges Not Covered
Staff recruitment	• The recruitment of an experienced team with the good location of the staff in the project areas. • The replacement of the monitoring and evaluation officer promoted to the position of National Project Coordinator. To maintain momentum in project monitoring and evaluation, an experienced M&E was recruited by IFDC. • The internal promotion of the M&E Officer as National Coordinator of the project was a success The departure and replacement of the communication specialist has been a success by IFDC. • The resignation of the administrative and finance officer. His replacement was assured by IFDC Mali's NAFO successfully	
Project document	Le redimensionnement à deux reprises du projet avec succès	
Intermediate Results (IR 1)		
Increased adoption of FDP and MD in targeted areas for millet, sorghum and vegetables (RMSL)	• At the beginning of the project, the results were very tentative with the conventional extension strategy. USAID had even threatened to close the project if IFDC continued with these results. It was necessary to rethink the strategies by taking the link of the private sector and by surrounding it with the other actors whose research one the aggressive communication. • Facilitate producers' access to fertilizer-based FDP and MD technologies	
Intermediate Results (IR 2)		
Increased private sector driven by supply and distribution of fertilizer products in targeted areas for RMSL	• The provision of 17 fertilizer briquette machines to economic operators, • Ensure a zonal distribution of machines for a regular supply of products • Cash purchase of briquette machines by operators. • Organization of promotional campaigns (caravan) for the supply of urea granulation service	• Reproduction of briquette machines and briquette applicators is an activity that needs to be encouraged and supported. These equipments are ordered from Bangladesh with their corollary of delay in the delivery. Reproduction will improve the supply capacity of urea briquettes, create added value and employment.

Project Management	Challenges Covered	Challenges Not Covered
		• The mechanization of the application of urea briquettes for the massive adoption of FDP technology. The manual application is labor intensive and difficult for certain categories of actors (e.g., the elderly). • The low equipment of women in agricultural equipment, because they are forced to wait for men to work their plots and unfortunately it causes a delay in view of the agricultural calendar that does not wait.
Intermediate Results (IR 3)		
Capacity building of key actors (IR 3)	• Training of master trainers (extension agents, producer leaders on the fundamentals of FDP and MD technologies) • Development of adapted training approaches to reach more people trained at lower cost (digitization approach)	Training and sensitization actions must continue for a wide coverage of this area, whose rice potential is very important for Mali.

V. LESSONS LEARNED

At the project management level:
- Avoid putting in a part-time key position such as monitoring and evaluation.
- Avoid multiplying the number of collaboration contracts.

At the level of the realization of the activities of demonstration and diffusion of the technologies FDP MD (IR 1)
Need to:
- Demonstrate the performance of technologies for user adherence.
- Involve the private sector in the diffusion of technologies.
- Involve the media (radio, TV, newspapers) in dissemination activities.

At the level of the realization of the activities of the private sector in the supply and the distribution of fertilizer products in the zones targeted for RMSL (IR 2):
- Involve the private sector in the import of FDP equipment (briquette machine, applicators).
- Bring local manufacturers for reproduction of FDP and MD equipment.
- Reproduce briquette machines and briquette applicators on place.
- Mechanize the application of briquettes for the massive adoption of FDP technology. Manual application is labor intensive and difficult for certain categories of actors (e.g., the elderly).

- Ensure aggressive communication to reach the maximum audience for information on FDP and MD technologies.

At the level of carrying out capacity building activities of key actors (IR 3):
- Introduce new information and communication technologies into training activities.
- Train producer leaders as trainers to ensure the cascading transfer of skills.

VI. FACTORS OF SUCCESS

Here are some success factors:
- The agronomic and economic performance by established FDP/MD technology (quantity of seed and fertilizer are reduced and an increase in yields per established crop).
- The availability of briquette machines in all project areas.
- The development and implementation of an aggressive communication plan.
- The involvement of the private sector in extension.
- Support to the producers' organization for the implementation of certain project activities in insecure areas.
- The development and implementation of adapted promotion strategies (caravan approach) to meet the demand for urea briquettes.
- The development and implementation of adapted capacity building strategies (digitization approach) to train the maximum number of people per cascade.

VII. SUSTAINABILITY FACTORS

As factors of sustainability:
- The Public-Private Partnership (PPP).
- Appropriation of communication strategies by the different actors (briquette production companies, technical extension services).
- Trust and synergy of action between the different players operating on the ground.
- The existence of a pool of trainers (extension agents, producer leaders) on the fundamental principles of FDP and MD technologies.
- The existence of a pool of mechanics, repairers of briquette machines in the four regions.
- Facilitating access to agricultural equipment for extension of the surface and better control of the agricultural calendar.
- The arrival of the Technologies for African Agriculture Transformation (TAAT) Project, which will benefit from the achievements of the FDP MD.

VIII. ANALYSIS OF THE MAIN STRENGTHS AND WEAKNESSES OF THE PROJECT

Table 5. Main Strengths and Weaknesses of the Project

Strengths	Weaknesses
• Agronomic and economic performance of established FDP and MD technologies • FDP and MD Technologies registered the National Agricultural Campaign Plan • Maintenance and repair teams for pelletizing machines available in each region • Private sector membership in technology diffusion • Availability of briquette machines in the four regions (Sikasso, Segou, Mopti, and Timbuktu) • Financing mechanism for inputs developed by the private sector (banking intermediation) • Innovative approaches developed for producer training (digitization of agricultural advice) and product promotion (caravan) • Communication tools (radio, video, TV, newspapers) available for technology promotion • Implementing technical partners (technical services, NGOs, GIEs and private sector) available to lead the popularization actions of FDP MD technologies • Producer Leaders trained to ensure the cascading transfer of FDP and MD technologies • Ecological technologies	• Importing FDP equipment (briquette machines, applicators) by the project without the local private sector • Application of FDP and MD technologies requires more work tomorrow • Poor quality of applicators

IX. CONCLUSION

The FDP MD project has just completed its five years of implementation. He managed to stay the course despite a difficult security environment in three of his four areas of intervention. The project has adapted to this situation by developing appropriate measures. The project has also been able to provide adequate responses to implementation challenges in most cases. The targets established at the level of the three IRs have been reached for most cases or exceeded.

While the FDP and MD technologies are restrictive in their application, they provide huge gains. Gain for the producer (on seeds and fertilizers), increase crops yield and gross margin doubled in some cases; Gain for the producer of fertilizer briquettes, through job creation and an average income of 3 million per year; Gain for the state, the increase of the number of producers and acreages, thanks distribution of subsidy fertilizer on the MD standard; and Gain for the environment with less risk of pollution (air and water).

The project organized a capitalization workshop, which served as a framework for exchange and sharing of project achievements with all project partners. The holding of this workshop contributed to the achievement of the following specific objectives:

- Share and validate the results obtained by the project during the five years with the actors.
- Share and validate the changes achieved by the stakeholders due to the implementation of the project.
- Reflection of the stakeholders on the sustainability of the changes made by the project.
- Share the perspectives after the end of the project.

At the end of the day's work, some of the recommendations were made by the participants, whose inclusion will open a new horizon for FDP and MD technologies. The main recommendations are:

- Advocacy for the extension and expansion of the project throughout Mali (IFDC).
- Continue with digitization consulting by organizing actors around an innovation platform (private and popular).
- Find guarantees adapted to access to credit (Private and MFI and Bank).
- Develop synergy between the different USAID projects to facilitate access to credits (Projects/Programs).
- Support (training, subsidy, networking) local artisans for the manufacture of equipment: seeders, transplanters, granular, applicators (Private, IFDC and other Projects).

ANNEX 1. ACHIEVEMENTS BY INDICATOR AND GAPS EXPLANATIONS

USAID-FTF-FDP MD Indicators	Baseline	LoP Cumulative target 2014-2018	Cumulative Achievement to date	% Global achievement April 2014 to date	Gaps Explanations
		E	D	F=D/E	
Adoption of Improved Technologies (FDP and MD)					
EG.3.2-18: Number of hectares of rice land under FDP technology or management practices with USG assistance	88	**84,381**	**90,672.64**	**107%**	
EG.3.2-18: Number of vegetable land under FDP technology or management practices with USG assistance (ha)	0	**1,200**	**1,199**	**100%**	
EG.3.2-18: Number of hectares of millet/sorghum land under MD technology or management practices with USG assistance	262	**155,992**	**184,430**	**118%**	The target was surpassed by the combined effect of the digitization method, which reached a large number of millet/sorghum producers and other producers, as well as the distribution of publicly subsidized the basis of the MD standard by the Mopti DRA.
EG.3.2-17: Number of rice farmers and others who have applied FDP technology or management practices with USG assistance (RAA)	0	**156,301**	**189,647**	**121%**	The target has been surpassed by the use of the digitization method, which has reached a large number of rice farmers and others.
EG.3.2-17: Number of vegetable farmers and others who have applied FDP technology or management practices with USG assistance (RAA)	0	**4,800**	**5,611**	**117%**	Exceeding the target is due to the high availability of water this year, which has been favorable for vegetable production. It should be noted here, the great involvement of women in the project activities.

USAID-FTF-FDP MD Indicators	Baseline	LoP Cumulative target 2014-2018	Cumulative Achievement to date	% Global achievement April 2014 to date	Gaps Explanations
		E	D	F=D/E	
EG.3.2-17: Number of millet/sorghum farmers and others who have applied MD technology or management practices with USG assistance (RAA) (WOG)	81	**159,018**	**176,407**	**111%**	The target was surpassed by the combined effect of the digitization method, which reached a large number of millet/sorghum producers and other producers, as well as the distribution of publicly subsidized the basis of the MD standard by the Mopti DRA.
Number of FDP adopting rice producers on farms larger than 2 ha who use granule applicators	0	**1,563**	**1,619**	**104%**	
(EG.3-1) Number of households benefiting directly from USG assistance under Feed the Future	0	**242,267**	**237,943**	**98%**	
GNDR-2 Proportion of female participants in USG-assisted programs designed to increase access to productive economic resources (assets, credit, income or employment)					
Number of female 10 - 29 years X	0	**565**	**22,114**	**3914%**	
Number of female 30 years and over X	0	**360**	**14,769**	**4102%**	
Denominator Y	0	**1,190**	**139,026**	**11683%**	
Proportion of women old 10-29 years X/Y%	0	**0.95**	**72%**	**76%**	
Proportion of women old 30 years and over X/Y%	0	**0.61**	**52%**	**85%**	
EG.11-6: Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance (FDP and technologies users)	0	**217,952**	**227,791**	**105%**	

USAID-FTF-FDP MD Indicators	Baseline	LoP Cumulative target 2014-2018	Cumulative Achievement to date	% Global achievement April 2014 to date	Gaps Explanations
		E	D	F=D/E	
EG.11-6: Number of people using FDP technology to improve resilience to climate change	0	**116,199**	**115,644**	**100%**	
EG.11-6: Number of people using MD technology to improve resilience to climate change	0	**101,753**	**112,107**	**110%**	
EG.3.2-20: Number of for-profit private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations (CBOs) that applied improved organization-level technologies or management practices with USG assistance	0	**692**	**3,130**	**452%**	The Producer Organization (PO) is the entry point of the project to reach the producers. Here, there was an underestimation of the target. Indeed, several small POs that actively participated in the deployment of FDP and MD technologies that were identified and registered by the ETPs during the implementation of the activities. There are hundreds of registered POs that each have fewer than 10 producers as members.
Productivity					
Total quantity of targeted nutritious value chain commodity produced by direct beneficiaries that is set aside for home consumption (custom) mt	**12,747**	**933**	**408**	**44%**	
EG.3.3-11: TBD3) Total quantity of targeted nutrient-rich value chain vegetables commodities produced by direct beneficiaries with USG assistance that is set aside for home consumption (mt)	11,055	**377**	**226**	**60%**	

USAID-FTF-FDP MD Indicators	Baseline	LoP Cumulative target 2014-2018	Cumulative Achievement to date	% Global achievement April 2014 to date	Gaps Explanations
		E	D	F=D/E	
Average rice yield increase in fields under FDP (compared to urea broadcasting) (+mt/ha)	Yield 4 mt/ha	+2670 kg/	+2588 kg/ha	**97%**	This rate of realization is justified by the good winter season and a good distribution of precipitation
Average millet yields increase in fields under MD (compared to the farmer practice) (+mt/ha)	Yield 0.8 mt /ha	**+600 kg/ha**	**+732**	**120%**	idem
Average sorghum yields increase in fields under MD (compared to the farmer practice) (+mt/ha)	Yield 0.9 mt /ha	**+1000 kg**	**+1352**	**135%**	idem
Profitability for Farmers					
EG.3.6-7: Farmer's gross margin per hectare of rice under FDP obtained with USG assistance (in +$)	$269	+$1,600	+1,604	**100%**	This rate of realization is justified by the good winter season and a good distribution of precipitation
EG.3.6-7: Farmer's gross margin per hectare of millet under MD obtained with USG assistance (in +$)	$179	+260	+577	**222%**	Idem
EG.3.6-7: Farmer's gross margin per hectare of sorghum under MD obtained with USG assistance (in +$)	$183	+210	+397	**189%**	Idem
EG.3.2-19: Value of small-holder incremental sales generated with USG assistance on MD and FDP implementation (in +$)	148,473	28, 896,127	**20, 082,625**	**69%**	The value of this indicator needs to be updating. It must be updated by adding the additional sales values rice, millet and sorghum of the 2018 campaign. These data are not available now.
Profitability for Input Suppliers					
Total volume of DAP or NPK sold through input supplier as a result of FDP and MD scaling up (in metric tons) (custom)	0	**13,785**	**14,883**	**108%**	

USAID-FTF-FDP MD Indicators	Baseline	LoP Cumulative target 2014-2018	Cumulative Achievement to date	% Global achievement April 2014 to date	Gaps Explanations
		E	D	F=D/E	
Total volume of urea briquettes sold through input suppliers as a result of FDP scaling out (in metric tons) custom	0	**9,757**	**10,097**	**103%**	
EG.3.2-22: Value of new private sector capital investment in the agriculture sector or food chain leveraged by Feed the Future FDP and MD technologies implementation (RAA) $	0	**142,000**	**114,872**	**81%**	In the deployment of FDP and MD technologies, the new investments mainly concern the acquisition of briquette machines, applicators and motor pumps. The applicators have been removed from the sales channel because of their poor quality. This has actually impacted the target attainment level of this indicator.
EG.3-9: Number of full-time equivalent (FTE) jobs created with USG assistance	0	**1,456**	**350**	**24%**	The target has been a lot of ambitious. In agriculture, it is very difficult to register a job creation on the basis of the full-time equivalent described in the FTF handbook. The full-time equivalents made by workers on brick machines and women's and youth groups for the application of FDP were recorded under this indicator.
Capacity Strengthening					
EG.3.2-1: Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training FDP Technology	0	**297,257**	**308,682**	**104%**	
EG.3.2-1: Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training MD Technology	0	**279,755**	**284,865**	**102%**	

USAID-FTF-FDP MD Indicators	Baseline	LoP Cumulative target 2014-2018	Cumulative Achievement to date	% Global achievement April 2014 to date	Gaps Explanations
		E	D	F=D/E	
Network Development					
Number of private agro-dealers or empowered producer organizations operating a briquetting machine in each FDP site	0	**12**	**17**	**142%**	Several operators have invested in the acquisition of briquette machines, following the awareness and communication campaigns implemented by the project (at regional workshops, the national forum on the FDP, and individual exchanges with potential buyers) on the business opportunity around the production of fertilizer briquettes. 16 machines were bought in cash by private operators, on credit by a women's cooperative.

ANNEX 2. LIST OF INDICATORS

EG.3.2-18: Number of hectares of rice land under FDP technology or management practices with USG assistance

EG.3.2-18: Number of vegetable land under FDP technology or management practices with USG assistance (ha)

EG.3.2-18: Number of hectares of millet/sorghum land under MD technology or management practices with USG assistance

EG.3.2-17: Number of rice farmers and others who have applied FDP technology or management practices with USG assistance (RAA)

EG.3.2-17: Number of vegetable farmers and others who have applied FDP technology or management practices with USG assistance (RAA)

EG.3.2-17: Number of millet/sorghum farmers and others who have applied MD technology or management practices with USG assistance (RAA) (WOG)

Number of FDP adopting rice producers on farms larger than 2 ha who use granule applicators

(EG.3-1) Number of households benefiting directly from USG assistance under Feed the Future

GNDR-2: Proportion of female participants in USG-assisted programs designed to increase access to productive economic resources (assets, credit, income or employment)

Number of female 10 - 29 years X

Number of female 30 years and over X

Denominator Y

Proportion of women old 10-29 years X/Y%

Proportion of women old 30 years and over X/Y%

EG.11-6: Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance (FDP and technologies users)

EG.11-6: Number of people using FDP technology to improve resilience to climate change

EG.11-6: Number of people using MD technology to improve resilience to climate change

EG.3.2-20: Number of for-profit private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations (CBOs) that applied improved organization-level technologies or management practices with USG assistance

Total quantity of targeted nutritious value chain commodity produced by direct beneficiaries that is set aside for home consumption (custom)

EG.3.2-18: Number of hectares of rice land under FDP technology or management practices with USG assistance

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Total quantity of targeted nutritious value chain commodity produced by direct beneficiaries that is set aside for home consumption (custom)

ANNEX 3. LIST OF PARTNERS

Intervention Areas	Local Implementing Partners		
	N°	Structure	Contact
Mopti	1	Direction Régionale de l'Agriculture (DRA)	Direction Régionale de l'Agriculture (DRA) de Mopti, Quartier: Secteur I Sévaré/Mopti – Mali, BP: 29, Région de Mopti Tél./Fax: (223) 21 420 150/ 21 450 083
	2	Office Riz Mopti (ORM)	Office Riz de Mopti (ORM) Tel/Fax: (223) 21 42 00 55/ 21 42 01 89; Cell: (223) 66 76 62 89 / 75 16 90 30; BP: 161 Région de Mopti; Email: officerizmopti2yahoo.fr
	3	Planète Distribution	Ousmane CISSE, Sévaré ATTBOUGOU Près du Conseil Régional Mopti Tél: 76 26 64 95 / 71 62 46 74
	4	PEENAL	Amadou DIOP, Mopti. Email: Giepeenal08@yahoo.fr, Tél: 76 26 78 48
	5	SOKAF sarl	Société Katilé Et Fils Agri-Sarl (SOKAF AGRI-SARL) - Siege Social Mopti Sévaré - Quartier Bamako-Coura Secteur 1; Tel/Fax: (00223); Cell: (223); 76 96 19 35/96 41 42 42/62 65 96 02
	6	Plateforme Riz Mopti	Soumana COULIBALY, Mopti. Email: pacoul@yahoo.fr, Tél: 65 89 49 96
Sikasso	7	Direction Régionale de l'Agronomique (DRA)	Phelix TOGO Tel/Fax: (223) 21 62 00 39; Cell: (223) 66 79 46 17; (223) 21 62 00 39 BP: ……Région de Sikasso; Email: dra_sikasso@yahoo.fr
	8	Coopérative Sène Yiriwaton	Coopérative Sène Yiriwaton; Yorosso; Cell: (223) 75 34 80 57; Région de Sikasso; Email: goitamadou@gmail.com
	9	GIE Promotion Agriculture Durable Sikasso (PADS)	Seydou CISSE, Sikasso. Email: seydoucisse17@yahoo.fr; Tél: 65 56 72 20 / 70 17 80 34
	10	Centre de Recherche Appui Développement Rural (CRADR)	Frédéric SANOGO, Sikasso. Adress email: cradre86@gmail.com, Tél: 66 66 09 72

Intervention Areas	Local Implementing Partners		
	N°	Structure	Contact
Segou	11	Faranfasi So	Fédération des Centres Faranfasi-So, Zone Office du Niger – Mali, BP 02 Cité Administrative-Niono, Région de Segou Tél./Fax: (223) 21 35 21 14
Timbuktu	12	Direction Régionale de l'Agriculture (DRA)	Direction Régionale de l'Agriculture (DRA) de Timbuktu, Timbuctu – Mali, BP: …… , Région de Timbuktu Tél./Fax: (223) 21 92 10 42/ 65 78 49 79
	13	SOPROTRILAD	Société de Production et de Transformation du Riz dans le Lac Debo (SOPROTRILAD); BP: 2787, Rue 385, Porte 231 – Hamdallaye ACI 2000 Bamako, République du Mali; Cell: (223) 78 45 38 80 / 76 24 64 98; Email: soprotrilad@yahoo.fr