



UNIVERSITY CHEIKH ANTA DIOP
OF DAKAR - UCAD -



Master's in Development
Practice Secretariat

THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

GLOBAL MASTER'S IN DEVELOPMENT PRACTICE UCAD CAMPUS

MacArthur
Foundation

Field Training Report

CONSERVATION FARMING

*Technological Innovation for a sustainable improved crops
production*

Rural Community of Toubacouta



Presented by

Djibril OUATTARA

Student in MDP Program

June-July 2011

TABLE OF CONTENTS

PICTURES, TABLES ET GRAPHICS.....	III
ABBREVIATION AND ACRONYMS:.....	IV
ABSTRACT	V
INTRODUCTION.....	1
CHAPTER 1 PRESENTATION OF THE STUDY	3
A. Framework of the Study	3
B. Issues and objectives	5
C. Methodology	6
CHAPTER 2 CONSERVATION FARMING SYSTEM.....	8
A. Description of the technique.....	8
B. Organization of the implementation of the CF	13
C. Effectiveness of the technique.....	16
CHAPTER 3: OPPORTUNITIES AND CONSTRAINTS IN	22
A. Economic and socio-economic importance.....	22
B. Environmental significance	24
C. Constraints in Conservation Farming	25
CHAPTER 4: RECOMMENDATIONS FOR.....	27
A. Current actions for improving	27

B. General recommendations for improving the system of time.....	27
C. Operational recommendation: Establish a perimeter of improved	28
CONCLUSION.....	33
BIBLIOGRAPHIE	34
ANNEXES	35

PICTURES, TABLES ET GRAPHICS

Pictures:

<u>Photo n°1:</u> Furrows in a CF field.....	8
<u>Photo n°2:</u> Holes in a CF field of the village Medina Sangako.....	8
<u>Photo n°3:</u> Compost in a CF field of the village Médina Sangako.....	9
<u>Photo n°4:</u> Mulching in CF field (2010)	10
<u>Photo 5:</u> Maize with CF (2010)	15
<u>Photo 6:</u> Millet with CF (2010)	16
<u>Photo n°7:</u> Millet production with CF (2010)	19

Tables:

<u>Table 1:</u> Types of soil in of Toubacouta	4
<u>Table 2:</u> Evolution of number of CF group	11
<u>Table n°3:</u> Partnership with CF groups	12
<u>Table n°4:</u> Table agronomic results (CF à Toubacouta)	13
<u>Table n°5:</u> Comparison between CF fields and non CF fields	14
<u>Table n°6:</u> Benefits with a CF field	16
<u>Table 7 :</u> Excess production with CF	18
<u>Table n°8:</u> Production of improved seeds end using	24
<u>Table n°9:</u> Benefits from production improved seeds without refund ...	25

Graphics:

<u>Graphic n°1:</u> Distribution of areas/ crops	13
<u>Graphic n°2:</u> Benefits from production improved seeds without refund	26

Abbreviation and Acronyms:

ACEP: Alliance pour le Crédit et l'Épargne

ANSD: Agence Nationale de la Statistique et de la Démographie

CF: Conservation Farming

CR: Communauté Rurale

DRDR: Direction Régionale du Développement Rural

FCFA: Franc de la Communauté Financière d'Afrique

GOANA: Grande Offensive Agricole pour la Nourriture et l'Abondance

ONG: Organisation Non Gouvernementale

PLD: Plan Local de Développement

REVA: Retour Vers l'Agriculture

SES: Situation Economique et Sociale

USAID: United States Agency of International Development

U.I.M.C.E.C: Union des Institutions Mutualistes Communautaires d'Épargne et de Crédit

Abstract

This report was produced through the Field Training conducted as part of the Global Master's in Development Practice (MDP), Dakar Campus (UCAD) in mid 2011. It comes from an individual report related to the analysis of the Conservation Farming (CF) introduced in Senegal by the United States Agency for International Development (USAID). Like the MDP program, the current analysis has a multi-disciplinary nature as it addresses a cross-cutting between the following areas: technology, economics & management and environment. Indeed, the CF is a production technology with economic opportunities and significant environmental benefits. It is as a production system based on soil conservation or even improvement of its productive capacity in order to obtain optimum, regular and sustainable yields. This technique is practiced in several stages:

- ✓ Tracing furrows or digging holes depending on the choice
- ✓ Application of inputs: compost (natural) and fertilizer (NPK) in small quantity
- ✓ Sowing after rain
- ✓ Covering of ground with straw
- ✓ Application of urea in small quantity

The CF was initiated in Senegal in 2009 by USAID-Wula Nafaa, a Program of USAID-SENEGAL. It is a whole system with its technological procedure and its organizational process. It concerns three cereal crops: millet, sorghum and corn. These cereals are the essential food crops of the country in addition to rice.

Among areas where the CF is practiced, we analyzed the case of the Region of Fatick, precisely the Rural Community of Toubacouta. This area shelters one of the most beautiful bays of the world. That shows the environmental potential of this part of the country and the need of an agricultural system that have not any negative impact on environment.

The CF practice offers many opportunities in terms of economic and social development and in terms of environmental protection. It is both a real way of mitigation of the climate change and adaptation to its effects.

The analysis conducted in the paper followed a practical methodology. It is based on both quantitative data and qualitative information. The data collecting use interviews with farmers and the USAID agents. A part of data was provided by the evaluation documents produced by USAID-Wula Nafa and the regional office of rural development. After one year of practice

the yields has been estimated. Fields have been randomly selected and compared according to a counterfactual principle in order to determine the CF method's impacts on the quality and quantity of the production of the three crops. They were compared to the neighboring non CF fields belonged most of the time to the same farmers.

In the document most of data have been tabulated after being treated. The different calculations and graphic presentations mainly used "Excel".

The report is divided into four parts and deals firstly with the framework of the CF application.

In the second part, the CF technique is presented in detail through the different agronomic steps, the organizational systems of CF producers groups and the effectiveness of the production process. The cost-benefit analysis shows clearly the benefits that farmers can obtain from cultivating with this technique despite the climatic conditions. It permits to farmers to face the negative effects of climate change.

The third part shows the opportunities offered by the CF and constrains faced by farmers in practicing the CF. Through the increasing of yields, the CF permits to improve the productivity level agriculture. It is a good way to guarantee food security and to fight poverty. The CF is at the same time a solution to mitigate the climate change evolution. Indeed, there are several advantages for environment such as the conservation of soil quality. For example, compost provides the organic elements necessary for a good quality of soil, the reduction of using of chemical fertilizers and pesticides reduce the risk of lands salinization which is a serious problem in the region, cessation of fire using for clearing fields, etc. Therefore the CF enables going from extensive farming to intensive farming while conserving the soil quality. At the same time, intensive farming favors the environment protection because it avoids the destruction of some part of forests and savannahs for agricultural using.

However, producers face some constraints in their production activities. Possible solutions are proposed to reduce constraints and ensure the sustainability of the CF system. Setting up a perimeter of improved seed production in the region is an example of planned recommendation that is proposed in the report.

The CF is an appropriate solution to the problem of land degradation and a clear opportunity to improve agricultural productivity in the context of climate change. It deserves special

attention and must be adapted for more other crops. It is worth scaling out across the country, the sub-Saharan African countries, and even all the developing world.

I cannot end without thanking all those who contributed directly or indirectly to the production of this document. In particular, I extend my sincere thanks to the following people:

- ✓ *Professor Ahmadou Aly MBAYE, director of MDP Program/Dakar Campus ;*
- ✓ *Management team and teaching staff of MDP Program ;*
- ✓ *Mr le Sous-préfet de l'arrondissement de Toubacouta et le PCR de Toubacouta*
- ✓ *Mr Mamadou DIAGNE, chef du C.A.D.L. de Toubacouta*
- ✓ *Mr Amidou COLY, Facilitator USAID Wula Nafaa, his valuable collaboration was essential for the production of this report;*
- ✓ *Mr Samba Thiaw, leading producer the CF group of Keur Aliou Gueye ;*
- ✓ *All the of the différent CF groups, mainly in Keur Aliou Gueye, Medina Sangako et Bani ;*
- ✓ *MDP Students, particularly those who were at Toubacouta for the field training;*
- ✓ *All other people who brought me their support concerning this work paper.*

Introduction

Like other countries in sub-Saharan Africa, Senegal is a country whose population is highly dependent on primary sector. Senegal's population is 58% rural and about 53% of the workforce is in agriculture (ANSD, SES 2009). However, Agriculture contributes to the Gross Domestic Product (GDP) for about 16% (ANSD, Comptes Nationaux, 2010). Nowadays, the need for effective and appropriate policies in agriculture is well established. Besides, the interest which the Senegalese government attaches to this area is clearly visible through its various policies and programs implemented. Plans like REVA (2005) and GOANA (2008) are obvious examples.

Food safety is an important issue for all developing countries. In these countries, the food supply is highly dependent on imports and this is not economically sustainable. Increased agricultural production is presented as the best alternative and this requires an improvement in agricultural productivity, knowing both the size of the agricultural population and the size of lands used are already large.

The famous initiative "Feed the Future," of the US President, adopted in 2008, aims at the same time to enhance food security in the world. The political supports of the United States take into account the objectives of this initiative. These objectives include the control of water, increasing production and productivity, capacity building, taking into account the environment and natural resources, etc. The actions of the U.S. Agency for International Development (USAID) refer to it closely. In this context the "Agriculture and Natural Resources Management Program" USAID-Wula Nafa from USAID/SENEGAL introduced in Senegal in 2009 an Agricultural Technical called Conservation Farming (CF), "Agriculture de Conservation (AC)" in French.

This technique can be defined as a production system based on soil conservation or even the improvement of their natural productive potential (fertility), to obtain optimum yields and regular. It is a comprehensive management system of fertility. The Region of Fatick, a part of the intervention area of the program is concerned with this technological innovation that has already been proven is efficiency in Zambia before being adjusted for Senegal. The Rural Community of Toubacouta is one of the localities in this Region, and Conservation

Agriculture is practiced since 2010. After one year of adoption in the Rural Community, the technique has confirmed its effectiveness and the program USAID Wula Nafaa is working to ensure the sustainability of actions by preparing the post-program period. However, some constraints remain and there are still exploitable potential to enhance learning and improve outcomes from Conservation Agriculture. In this context the present work is devoted to the analysis of the Conservation Agriculture in the Rural Community of Toubacouta, the finality is proposition of possible actions for improvement.

In what context the Conservation Agriculture was introduced in Senegal and what are the physical characteristics of the features of the study? What are the main concerns and objectives of the current analysis? What was the methodology used to conduct the study? The answers to these questions will construct the first chapter of this document.

The Conservation Farming is a whole system with a developed technological procedure and organizational process for monitoring and evaluation. What are the steps for setting up a field CF? How does the organizational system of producers function around the Conservation Agriculture practice? Is the of CF technique effective as a production system? The second chapter of the work plans to address these issues.

The Conservation Agriculture offers many opportunities both in terms of economic development and in terms of environmental protection. However, there are some constraints for farmers to adopt the technique. The analysis of these opportunities, economic and environmental on one hand, and the presentation of the constraints on other hand will constitute the third chapter.

Some constraints have already been taken in account by the USAID program. However, a set of actions can be undertaken to enhance learning and ensure the sustainability of the implementation of Conservation Agriculture. That is what binds the fourth and final chapter of the report.

Chapter 1 *Presentation of the study*

The Conservation Agriculture analyzed in this document is a specific agricultural technology introduced in Senegal and monitored by USAID Wula Nafaa a program of USAID-Senegal. For accuracy reasons, the study is limited to the case of the Rural Community of Toubacouta; nevertheless the analysis is assignable to other places. After the presentation of the contextual situation, this first chapter presents on one hand the the fixed goals of this study, and one the other hand the methodological approach followed.

A. Framework of the Study

1. USAID Wula Nafaa

The program "Agriculture and Natural Resources Management" USAID Wula Nafaa is in its second phase for the period 2009-2014 after a first phase completed in 2008. This is a program of the United States Agency for International Development (USAID) in agreement with the Senegalese government. Its mandate is "improving food security". Its overall objective is "to contribute to poverty reduction and sustainable local development by increasing the incomes of rural producers and local communities, by empowering local authorities and the promotion of integrated, decentralized and participatory management of resources". Now involved in the Fatick Region in addition to Tambacounda, Kédougou, Kolda and Ziguinchor, USAID Wula Nafaa develops the Conservation Farming to meet the following objectives inscribed in its annual work plan:

Objective 1: "Increased productivity and agricultural production" with the following expected results"

Result1: "water management system improved or created";

Result2: "An improved crop and livestock production"

Result 3: “A better market integration of smallholder production for a number of key commodities”

Objective 2: “Promotion of principles based on a healthy market / Implementation of a healthy agriculture and a policy for food" with the outcome "stricter respect of rules related to the production and the using of technologies by small producers”.

The Conservation Agriculture developed by USAID Wula Nafaa began in July 2009 by a test in the regions of Tambacounda (Koumpentoum, Bamba, and Darou Minam Niani) of Kafrine (Nganda) and Kaolack (Thiara). The evaluation of this test demonstrated the relevance of this technique in terms of yields increasing. The implementation of the technique was extended to the Fatick region from the 2010 pluvial season. Thus, the four (4) Rural Communities in the district of Toubacouta which are Nioro Alassane Tall, Keur SaloumDiané, Keur Samba Gueye and Toubacouta were involved in the CF. For better accuracy of the analysis; this paper will focus on the case of the Rural Community of Toubacouta. However, the different elements of analysis will in principle be applicable to other Rural Communities where Conservation Farming is introduced.

2. The Rural Community of Toubacouta

The implementation of CF in the RC of Toubacouta is relevant to the extent that it is a city with strong agricultural potential to exploit.

Geographically the rural community is located in the District of the same name located in the Department of Foundiougne, Fatick region. It is bordered on the north by the Municipality of Sokone and the District of Djilor; on the south by the Rural Community of Keur Samba Gueye and the Republic of Gambia, on the East by the local communities Nioro Alassane TALL and Keur Saloum Diané and on the West by the Atlantic Ocean and the Borough of Niodior. It is officially composed of 51 villages which are over an area of 170 km² with 61.7% of arable land.

With an estimated population of 31,574 residents in 2009, the distribution of the workforce according to the main socio-professional activity is as follows: 75% for agriculture, 13% for fishing, 10% for livestock, and 2% for other activities such as tourism, beekeeping, etc.

Located between 400 and 1000 mm isohyets, the rural community of Toubacouta has a mild sub Canarian climate characterized by the alternation of two highly contrasting seasons: a dry season of nine months (October-June) and a rainy season or wintering three months (July-September). In terms of rainfall, the average ten-year is 746.97 mm (PLD RC of Toubacouta, 2009). Soil types found as follows:

Table n°1:

Soil types	Surfaces (ha)	Quality-Using
Dior (ferrugineux-tropicaux)	9 945	Low fertility, in degradation
Deck- Dior (clayey-sandy)	4 250	Stable and rich, suitable for grain crops, vegetable and fruit growing
Deck	1 530	Rich favorable to maraichage and rice production
Tannes	850	Acid and ultra salty, not favorable to agriculture
Sols de mangroves	425	Reduced use due to the tidal water
Total	17 000	

Source: *Local Development Plan (PLD) of Toubacouta*

B. Issues and objectives

1. Issues

The implementation of Conservation Farming system is a planned and detailed process. Indeed, the introduction of the technique is subject to a phased approach from the development of the fields to the harvest, through the creation of organizational dynamics within local communities and facilitating partnerships. This process is being closely monitored by the USAID-Wula Nafaa that prepares producers to ensure the sustainability of Conservation Farming after 2014.

The evaluation of the system, made with the producers after a year of practice revealed a success of the technique as an effective means of soil fertility and yields increasing. It deserves to be popularized and spread to other parts of the country.

However, some constraints were identified. These include lack of access to credit and inputs, the complexity of the implementation of technology, etc. These constraints will be presented later in detail. Some have already been mastered using new measures from the program, but others remain still unresolved.

2. Objectives

After, showing the advantages of the CF system, the overall objective of this work will be to propose concrete actions to remove constraints and lead to improvements in outcomes and strengthen the sustainability.

The specific objectives are:

Objective 1: Provide a system of management time spent on Conservation Agriculture.

Objective 2: Plan the installation of a perimeter of improved seed production in the rural community of Toubacouta.

Besides these objectives, it is also to analyze the different aspects of the Conservation Farming which is a good technique for sustainable agriculture, extension of which can push agriculture in Senegal.

C. Methodology

1. Data Collection

The preparation phase of this document was done using a simple methodology in light of the stress related to the time limit. The analysis of the data used both quantitative and qualitative information.

After an initial contact with the subject during an interview with the facilitator of the USAID Wula Nafaa program in the locality, the work consisted to collect the necessary information on the subject. This was done in various ways. Research on the subject was first made by reading articles on conservation farming, the training guide for the implementation of the CF and the evaluation document of 2010. Then the collection of information took place through a

series of interviews with the facilitator of the program on the one hand and producers on the other. This information gathering phase was accompanied by direct observation of field activities.

2. Data processing and Assumptions

The drafting of the document in turn has been gradual following the evolution of treatment process and data analysis. Most data were organized in tabular form after treatment. The Excel program was used for various calculations. Data on production and performance concern the year 2010. Estimates for 2011 were made with the assumption that the average yield per hectare remains constant from 2010 to 2011. The value of products is estimated by the average prices on the market. The same reasoning has been conducted regarding the price of inputs.

Chapter 2 *Conservation Farming System*

The Conservation Farming is a technological innovation that is organized around a well-developed agricultural procedure, accompanied by a organizational system and capacity building of producers. Before reaching the demonstration of the effectiveness of the technology, this chapter presents the organizational system related to CF, after describing the various stages of the implementation of CF.

A. Description of the technique

The Conservation Farming is based on the simultaneous implementation of three (3) principles at the scale of the plot:

- ✓ the minimum working of soil;
- ✓ associations and crop rotations;
- ✓ the permanent soil cover.

The concept of conservation is understandable on many levels.

First, there is conservation through the holes and grooves, of water and nutrients that the plant needs, and secondly there is the conservation or improvement of soil quality for future generations.

1. Stages of implementation

The Conservation Farming uses two technologies: a manual with the hoe "shaka" and technique coupled with the "Magoyer ripper" using invariably the donkey, ox or horse for traction.

After choosing the plot and the extent of the plot (to master the quantities of inputs), the practice of CF is a process of five (5) stages:

✓ **The furrows tracing or the holes digging.**

Concerning technology drawn, it is made a first passage in the dry season (hard ground) and a second passage after rains. These furrows of about 15 cm deep with a spacing of 80 cm;

Photo n°1:



Source: facilitator of USAID Wula Nafaa, 2011

Concerning manual technology, it is to dig holes 15 cm wide, 30 cm long and 15 cm deep with a spacing of 70cm.

This step is normally accompanied by the collection of inputs (chemical fertilizer and compost which is natural).

Photo n°2: Holes in a CF field of the village Medina Sangako



Source: Author

✓ **The application of inputs (fertilizers and compost) and close:**

This step refers to the use of compost completely extinguished and chemical fertilizer NPK (Nitrogen, Phosphorus, and Potassium)

Application of compost in the holes or furrows is done 2 to 4 weeks before the first rains in a quantity of 500small pots (tomato paste) per hectare, a division of a pot for a 25 meters furrow. You must complete both hands for spreading compost into the holes.

The application of chemical fertilizer is done using capsule or can of 33 centiliters by 20 meters (800 grams per 100 meter of furrow) for drawn technology. Concerning manual technology, it is a capsule of 5 grams of fertilizer per hole. The amount of chemical fertilizer used per hectare is 100 kg, two (2) bags of 50 kg.

It is important to close the holes or furrows after application of fertilizer to avoid the effects of wind.

Photo n°3: Compost in a CF field of the village Médina Sangako



Source: Author

✓ **Seeding after helpful rain:**

A useful rain is defined here as a rain evaluated at least at 20 millimeters (mm). The seeding must involve good quality seeds and take into account a good disposition of the seeds. In this matter, the standards call for 16 to 20kg of seed per hectare (ha) for corn, 8 to 10kg/ha for sorghum and millet, using a super-eco seeder drawn. This corresponds to 10 seeds per hole or 5 cm between seeds on a furrow line for sorghum, from 12 to 15 seeds per hole or 5 cm between seeds on the line for millet, 3 seeds per hole or 15 to 20 cm between seeds of line for corn.

The advantage of sowing after useful rain compared to dry seed is that it avoids the risk of a possible rainfall pause, allowing the plant take more advantage of the phenomenon of nitrogen explosion.

✓ **Covering with mulch or residue:**

This is to cover the surface between the furrows or between holes with straw (stalks of millet or corn for example). The benefits of mulching are numerous. It allows for example to limit the growth of weeds, conserve soil moisture, reduce wind and water erosion, and enrich the soil. If mulching is done poorly or very little consistent, it is recommended to take care to weed the field.

Photo n°4:



Source: facilitator of USAID Wula Nafaa, 2010

✓ **The application of urea:**

Application of urea obeyed the same process than the NPK fertilizer, except that the use of urea occurs after the development of young plants. The quantity of urea used per hectare is set at 100 kg.

2. Crops

The speculations involved in conservation farming are cereals. More specifically maize, millet and sorghum are concerned. The choice of these cultures is not hazardous. These cereals are the staple crops of the locality and one of the main objectives of the intervention USAID Wula Nafaa is to ensure food security.

B. Organization of the implementation of the CF

The introduction of the technique of the CF is based on a strong organizational aspect and sustainability of actions. The focus is placed on collective actions of producers.

1. The CF groups

In every village where the CF is practiced, it is formed a group comprising all the producers who adhere to the CF system, designated by the term "CF producers". The number of producers is about 15 for new groups and up to 35 for older groups. A producer called "leading producer" ("Producteur leader" in French) that will be a reference in the village in terms of Conservation Agriculture. A committee is also established for each CF group headed by a president who is not necessarily the leading producer. Producers are urged to develop the spirit of teamwork, which allows a better transfer of knowledge and experience

Besides, one of the main tasks of the leading producer is to ensure capacity building about the technique, especially for new producers of the group. Thus, we USAID-Wula Nafaa can ensure the sustainability of the practice of CF at the end of the program.

The general conditions for a producer to enroll in a CF group are:

- 1) belonging to the village where you want to register (have a house in the village);
- 2) Pay with the leading producer the enrollment fees equivalent to the amount required by the CF group in the village (this amount is mandatory and non-refundable);
- 3) Commit to bring in his field, fertilizer NPK 15-15-15 (May) and urea (July) in proportion to the area to be cultivated for the current year;
- 4) Commit to make compost in its field, equivalent to the area to be harvested;
- 5) Commit to track all training sessions provided by the facilitator of the program or the leading producer;
- 6) Commit to provide quality seeds to ensure better performance;
- 7) Commit to pay the contributions in the group without any claim for reimbursement in case of dismissal.

These conditions are not negotiable. Failure to comply with any of these terms and conditions is equivalent to a dismissal of the producer without refund of contributions handed in the group.

For each rural community, the number of village CF is changing gradually as a "spot of oil." The aim is to cover all the villages by the end of the program planned for 2014. More specifically, each village polarized CF 3 villages. That is to say that from a CF village in year n, the technique is introduced to three (3) new villages in year n + 1. This method results in homogeneous and compact areas of practice of CF. Thus the number of villages has increased significantly for each CR of the district of Toubacouta.

Table n°2:

CR \ Years	2010	2011
Nioro Alassane Tall	5	20
Toubacouta	4	15
Keur Saloum Diané	6	24
Keur Samba Gueye	4	16

Source: *USAID Wula Nafaa agent*

For the Rural Community of Toubacouta, the number of producers increased from 68 in 2010 to 277 in 2011. This increase results from two facts: the arrival of new producers with new groups and the increase in the number of members of the elder groups (see Appendix 2).

2. Functionality of the CF groups

Each new group benefits from a set of training related to the practice of CF (the steps, the use of tools, techniques, compost using, etc.). The training sessions are both practical and theoretical.

To ensure effective implementation of the technique, a maximum of 1 hectare is recommended for new producers, with a maximum of ¼ hectare for the manual technology. The former producers have the flexibility of up to 3 ha. For 2011 the average area for former producers is about 2 ha.

Another importance of the organizational aspect is to facilitate the establishment of necessary circuits for upstream markets and downstream markets of production. In this aim, USAID Wula Nafaa ensures facilitation to interlink the producers with the various actors in the sector. Upstream, actors are seeds providers, fertilizer suppliers, manufacturers of tools and financial institutions to facilitate access to credit. Downstream, there are buyers for the different products concerned by the CF (maize, millet, sorghum). Within this framework, the USAID program has brought together various stakeholders in Toubacouta in April 2011. During this meeting, the following actors presented their service offerings:

Table n°3:

Buyers	Seeds producers	Fertilizer sellers	Financial Institutions
<ul style="list-style-type: none"> • Agrosynergie <p><i>Buying agreement of 1600 tons of corn (with a need attaining until 3000 tons) ; reviewable</i></p> <ul style="list-style-type: none"> • SODEFITEX (with Bantaaré) 	<p>Group of individual producers of seeds from Thiaré (Région of Kaolack).</p> <p><i>Price/seeds : 400 FCFA/Kg for the 3 crops</i></p>	<p>S.E.D.A.B (certified operator)</p>	<ul style="list-style-type: none"> • A.C.E.P. de la commune de Passi for the news CF groups • U.I.M.C.E.C. for the fomer CF groups <p><i>Conditions of agreement: personal contribution 10% instead of 20%, and interest rate of 12% instead of 18%</i></p>

Source: Interviews with USAID agent and farmers

To facilitate contracting with partners, the groups were organized in networks for each rural community. Thus, the network of CR Toubacouta is composed of all the producers' groups in the 15 villages concerned.

The perspective is to establish federations across the Borough from the networks created.

For sustainable and easy access to tools, the program has provided training to two local artisans based in Toubacouta in the manufacture of tools.

C. Effectiveness of the technique

1. Increase in yields

The inventory of the CF practice in 2010 in the Rural Community of Toubacouta can be summarized by the following table:

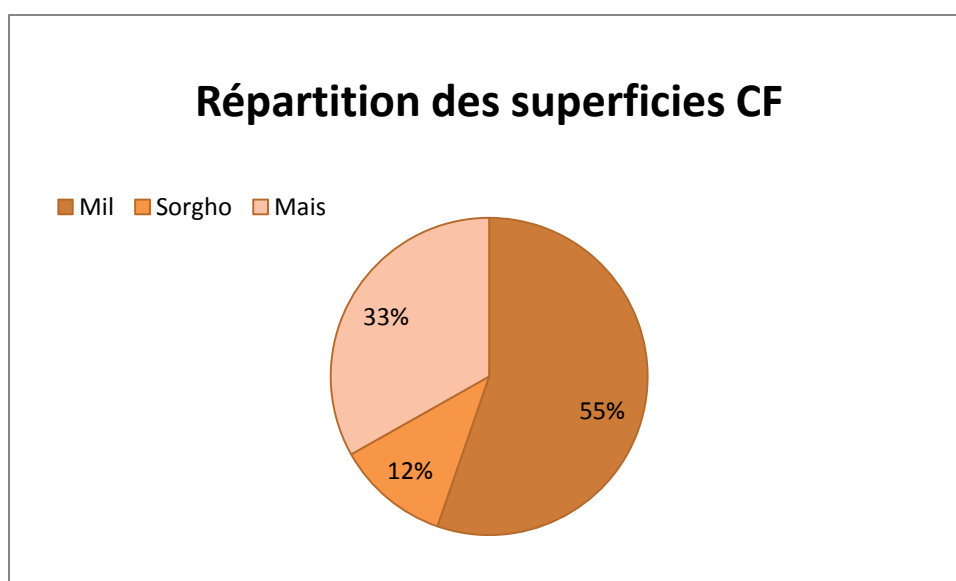
Table n°4:

CF Village or Site	Number of producers	Number of producers according technology		Surfaces/ crops (ha)			Total surfaces (ha)
		Drawn	Manual	Millet	Sorghum	Corn	
Némading	17	16	15	1	0	12	13
Diaglé	16	16		10	4,5	1	15,5
Dielmong	17	15	4	9	1	4	14
Keur Aliou Gueye	18	14	4	10	0,75	1	11,75
4 villages concerned		61	23	30	6,25	18	54,25

Source: Mid-term evaluation document, 2010

The area allocation according to the speculations is represented by the following graph:

Graphic n°1:



Source: Author

In the following, the same proportions will be considered by hypothesis for the 2010-2011 season, data on the distribution of land for various crops are not yet available

After one year of practice the yields has been estimated by the regional office of rural development (DRDR Fatick). Fields have been randomly selected and compared according to a counterfactual principle in order to determine the CF method's impacts on the quality and quantity of the production of the three crops. They were compared to the neighboring non CF fields belonged most of the time to the same farmers (see Appendix 2).

For each of the three (3) speculations, the elements of comparison were the number of seed hole, density, number of ears per 100 m², the weight of an ear, the yield per ha. Comparison of average yields according the field nature (CF and non-CF) for different crops in the CR Toubacouta gives the following results:

Table n°5:

Millet

15 CF farmers, 13 Non CF	CF fields	Non CF fields	Average gap
Average Number of seed holes	150,266667	137,923077	12,3435897
Average Density	15026,6667	13792,3077	1234,35897
Number of ears/100m ²	242,466667	210,076923	32,3897436
Average weight of ears	37,2893333	29,9475	7,34183333
Average yield	886,2	607,923077	278,276923

Sorghum

4 CF farmers, 4 Non CF	CF fields	CF fields	Average gap
Average Number of	113	192	-79

seed holes			
Average Density	11300	19200	-7900
Number of ears/100m ²	264,25	333,333333	-69,0833333
Average weight of ears	39,1125	18,41	20,7025
Average yield	953,5	752,333333	201,166667

Corn

8 CF farmers, 5 Non CF	CF fields	Non CF fields	Average gap
Average Number of seed holes	234,125	258,4	-24,275
Average Density	23412,5	25840	-2427,5
Number of ears/100m ²	216,875	239	-22,125
Average weight of ears	110,005	71,2775	38,7275
Average yield	2725,83333	1635	1090,83333

Source: Author from the data produced by Regional Rural Development of Fatick, 2010

For millet, the plots surveyed have a surplus of yield of 278 kg / hectare on average compared to neighboring non-CF plots. This extra yield is 201 kg / ha average for sorghum and about 1091 kg / ha for maize.

These results show that on average in the sample studied, fields exploited with Conservation Farming system have a higher yield. Without making tests taking into account all the fields, the conclusion that the CF is a factor of increasing returns can be drawn a priori. This conclusion is reinforced by the finding that has been done by all the producers who have practiced technology with the standards. This is also the main factor that attracts new producers in the system of conservation agriculture.

A priori, one can also say that Conservation Farming system has a positive effect on the quality of the ears. Indeed, in the sample studied, the ears from CF fields have the relatively

larger mass. To the extent that for sorghum and corn fields CF have a lower density and a lower number of ears / m² the quality of cobs is probably the factor explaining the excess return. The low density is probably due to the fact that the CF requires a minimum spacing between the plants in the furrows, which is also the case with holes in manual technology.

Photo n°5:



Source: facilitator of USAID Wula Nafaa, 2010

Photo n°6:



Source: facilitator of USAID Wula Nafaa, 2010

2. Cost-benefit analysis

The cost-benefit analysis of exploitation of a CF field can be by comparing the estimated market value of production and expenditures in inputs. These estimates will be done under the following assumptions:

- ✓ the land has been acquired without cost;
- ✓ No value is given to the compost because it does not cause real expense for producers
- ✓ The producer uses the improved seed and quantities used will be estimated by the
- ✓ average standards of CF: Millet and sorghum $(8 + 10) / 2 = 9$, Corn $(16 + 20) / 2 = 18$
- ✓ The production of the parcel in question (1 ha) is completely sold

The latter hypothesis lends a market value to production, but in reality, production is almost completely used up to now for direct consumption. The price on the market at Toubacouta at the time of preparation of this report was 250 CFA francs per kg for the three cereals. This is a high price because it is the beginning of the lean season. In times of abundance the prices turn around 150 CFA francs / kg. The estimated value will be made with the average price of 200 FCFA / kg.

The following table provides an evaluation of the benefits according to speculations selected:

Tableau n°6:

Crops	Seeds quantity/ha (Kg)	Cost of seeds/ha (FCFA)	Cost of NPK/ha (FCFA)	Cost of Urea/ha (FCFA)	Total cost (FCFA)	Production/ha (Kg)	Production value (FCFA)	Benefits/ha (FCFA)
Millet	9	3600	28000	16000	47600	886.2	177240	129640
Sorghum	9	3600	28000	16000	47600	953.5	190700	143100
Corn	18	7200	28000	16000	51200	2725.8	545160	493960

Source: Author

Conservation farming helps to ensure increased production while allowing a reduction in costs of inputs, especially fertilizer. This results in profits opportunities For each hectare, it

is possible to have a margin of profit of 493 960 FCFA for maize, 143 100 FCFA for sorghum and 129 640 FCFA for millet.

Chapter 3: *Opportunities and Constraints in the Conservation Farming*

The Conservation Farming is a real opportunity for the CR of Toubacouta to increase the production of cereals millet, sorghum and maize while maintaining soil fertility and environmental protection. It is a technology combining economic development and preservation of natural resources. These aspects are the subject of this chapter which will then present the constraints faced in the practice of CF.

A. Economic and socio-economic importance

1. Contribution to economic development

Through it promotes higher yields; conservation farming is a means of improving agricultural productivity. It also can be analyzed in terms of increase in overall quantities of cereals produced concerned.

Considering the average yield excess per speculation and the area under cultivation we can estimate the additional output obtained with Conservation Farming system. The areas according to the speculations for 2011 are calculated from the proportions of the 2010 campaign, the total planned area is 310 ha (see Appendix 2). Infixing the sale price at 200 FCFA / kg as above, the following results can be obtained for the rural community of Toubacouta:

Table n°7:

	Surfaces in 2010 (ha)	Surplus of production in 2010 (kg)	Market value of surplus 2010 (FCFA)	Surfaces in 2011 (ha)	Surplus of production in 2011 (kg)	Market value of surplus in 2011 (FCFA)
Millet	30	8348,308	1 669 661,54	170,5	47 446,22	9 489 243,07
Sorghum	6,25	1257,29	251 458,33	37,2	7 483,40	1 496 680
Corn	18	19634,99	3 926 999,99	102,3	111 592,25	22 318 449,9
Total	54,25		5 848 119,86	310		33 304 373

Source: Author

CF introduces a considerable increase in production. It is estimated by more than 111 tons of surplus in maize production which can be obtained thanks to the technology in 2011, worth over 22 million FCFA. This surplus was almost 20 tons in 2010, worth nearly 4 million. This surplus is respectively estimated at more than 47 tons of millet and about 7.5 tons of sorghum in 2011 so approximately 9.5 million and 1.5 million.

It can be expected in the long term a significant increase in the agricultural sector's contribution to the economy in the rural communities with the increasing number of CF villages. Thus, the Conservation Farming can contribute to economic development in the rural community.

2. Food security and poverty reduction

In the short term, the implication would be an improvement food security. Production in food crops is primarily devoted to direct consumption; conservation farming contributes to the increase in the livelihoods of people.

The example of the leading producer of the CF group of the village Keur Aliou Gueye is a concrete illustration. He devotes this year (2011) an area of 3 hectares to the conservation farming technology, 2 ha for millet and 1 ha to sorghum. For the 2010 campaign, his farm was concerned CF millet crops on a plot of 1 ha. He says that he tested the technique by challenging a parcel that has long had become low yield with only 300kg/ha. However, he harvested 818kg of millet with the practice of conservation farming and strongly testifies

to the effectiveness of the technique. He estimates that the 2010 production is sufficient to cover his family's needs until the next harvest.

Allowing producers to ensure surplus production over their needs, CF directs them to sell on the market. It will thus turning them into true business by providing a reliable source of income. Then it is a way to fight against poverty within the rural community and other locations housing the technique.

Photo n°7:



Source: *facilitator of USAID Wula Nafaa, 2010*

B. Environmental significance

The Conservation Farming is a very effective method of rapid fertilization and of regeneration of soils over time. The use of compost provides soil organic elements necessary for its good quality. For this reason, the Conservation farming enables going from extensive farming to intensive farming. This is an important factor for environmental protection because many of the areas of forest and savannah are spared from this fact.

Ensuring soil fertilization, and also supplies plants with water (stored in furrows and holes), Conservation Farming system is a form of adaptation to climate change. It ensures good yields by reducing the impact of climate risks in terms of rainfall

Conservation farming is also a good alternative to abandon agricultural practices such as using fire clearing the fields. This constitutes another way to protect the soil because fire impoverishes the soil over time.

Using the CF technology greatly reduces the use of chemicals such as fertilizers and pesticides. Traditionally, standards for the use of fertilizers stood between 150 and 200 kg/ hectare both for NPK and for urea. The standards required for the CF technology determine the quantity at 100 kg/ hectare for each of these two inputs. One implication is the reduction of chemical inputs that have impacts on the soil like salinization and groundwater such as groundwater pollution and its consequences on the health of populations.

The use of compost fills in for the reduction of fertilizer used and mulching helps to fight against weeds such as “Striga” while more fertilizing. In addition, it is an effective factor for cleaning up because there has been an interest in garbage collection at the village level to obtain the compost.

C. Constraints in Conservation Farming

Constraints were identified during the mid-term evaluation meeting in September 2010 made on the scale of the Rural Community with producers including two representatives for each CF group. The same constraints were highlighted during our interviews with producers in the context of the development of this work.

1) Work time and work conditions constraints

The late start of activities and the slow evolution of the work related to the complexity of the implementation of the CF technology for some producers have been presented as a constraint. Late sowing has resulted in some cases attacks of insects such as cantharis on millet. The producers also point out that the long preparation of the plots compromising other activities. The work in the dry season, when soils are dry and hard, is painful, especially for digging holes. The transport of compost was also a problem highlighted by some producers. The quantity of compost used is important as not all have a cart to transport.

2) Lack of access to credit, inputs and seeds

Problems related to accessibility of inputs (fertilizers, improved seeds) were raised. These problems were exacerbated by the difficulties of access to credit. Indeed, the problem of financing was an obstacle to the conduct of activities at the beginning because the

producers did not have the resources to purchase fertilizer and seeds. Regarding the subsidized fertilizer, it is still insufficient compared to needs. Actions were undertaken in these subjects. In this aim the program has completed the facilitation of partnerships between producers and actors of the agricultural sector (seed, fertilizer suppliers, buyers). Improved seeds are a condition of opening the market to producers because demand is oriented towards products that result. However, these seeds have a cost and action can be taken to improve the situation. This subject is developed in the next chapter.

3) The inadequacy of tools

Producers also mentioned the inadequacy of tools for different stages of the technology. This constraint was taken into account in the formation of the two (2) artisans in Toubacouta. However, producers would like to have still a better adaptation tools. Proposals have also been expressed for possible versatile tools. That means the possibility to trace (furrows) and sow with the same tool after a little manipulation. In addition, the work would be much easier and faster with tools adapted to the tractor.

4) The organizational problems

Organizational difficulties were highlighted in the case of certain groups. The collective work creates constraints and CF groups are still young for a perfect organization. The collective use of such tools is a constraint and this shows the interest to start work early. These difficulties are probably related to youth of CF groups. Through monitoring and coaching of the program, the situation is improving with time.

Chapter 4: *Recommendations for Strengthening of learning and sustainability*

Given the constraints identified at the end of the previous chapter, it is useful to undertake concrete actions to achieve the desired results. In addition to measures already envisaged by the program, recommendations for improving the functioning of the CF system are presented in this chapter. One of the major recommendations is the establishment of a perimeter of improved seed production in the rural community.

A. Current actions for improving

Several measures have been provided by the Program in response to suggestions for improvement made during the evaluation process. The objectives are pursued through several actions. It is to:

- ✓ Develop a participatory nature to ensure internal expenses related to the organization of groups and networks;
- ✓ Support the producers in the marketing of crops;
- ✓ Support the producers access to inputs (fertilizers and seeds) in time;
- ✓ Facilitate the storage of the harvest for marketing;
- ✓ Strengthen the technical and managerial capacities of the leading producers;
- ✓ CF system Adapter hardware requirements for producers;
- ✓ Reflect on the possibilities of using herbicides in case of delay in the semi.

B. General recommendations for improving the system of time management of the CF

Constraints related to the implementation of CF system fields are due to the complexity of the process of preparing the plots for many producers.

From measurement of plots to sowing through the tracing furrows (or digging holes) and application of inputs, the practice of Conservation Farming requires a lot of effort and time. However, producers would be able to allocate that time working in the dry season in other activities such as gardening, small businesses, etc. This paragraph is intended to explore some possible solutions for a better reconciliation of CF system with other activities. This is necessary because most farmers in the community are called to gradually adopt the technique, given the speed with which technology is diffused in the locality.

A key element in facilitating the work is the adaptation and availability of tools. The issue of improved tools should be a general discussion involving the program, specialists in the design of tools and producers. It is important that the tools are being tested by the producers before mass production. It would be interesting to make versatile tools. This would facilitate the acquisition and management by producers. The adaptation of tools for using of tractors is a good initiative that is being tested now.

For facilitating the work, it would be better to make digging for next year very early after harvest while the holes are not completely closed. Composting could possibly do at that time also; it would allow producers to have more time for other activities during the dry season, not to lag behind the practice of CF system.

C. Operational recommendation: Establish a perimeter of improved seed production

The Conservation Farming provides increased production and better organization of producers. They will soon be ready to provide a consistent supply of grain to market. The concerned production by an increased demand is from improved varieties. The seeds are also of paramount importance in increasing yields. To ensure for producers of the Rural Community of Toubacouta a good market integration concrete actions are necessary for a sustainable resolution of constraints in the supply of improved seeds. In this regard, the establishment of a perimeter production of improved seeds is useful and beneficial.

Improved seeds that will be affected are:

- ✓ The "Suna 3" for millet;
- ✓ The "Jasumbe" for sorghum;

✓ Varieties "Souwane" and "Early Thai" for corn

The proposed location for the implementation of this perimeter is the village of Keur Aliou Gueye. This is a village about 5 km from the capital of the Rural Community (Toubacouta).

The group CF Keur Aliou Gueye is an old group with a workforce that has grown from 18 members in 2010 to 22 in 2011, including 2 women. The total area for conservation farming is about 30 ha. This is a dynamic group that meets at least once a week to review the activities and share experiences.

Although group work is not always easy, the group of CF Keur Aliou Gueye demonstrated a good group dynamics, as desired by the program. Indeed, a number of activities such as measuring plots, transportation and application of compost are made collectively by producers.

The group is organized so that the membership was set at 1000 FCFA in 2010, is 1000 FCFA for former members and 2000 FCFA for new members in 2011.

These contributions were used to open an account and used to adjust operating costs. Another initiative is the collective field contribution that the group has set up. In 2010, there cultivated the "hibiscus" soon to be sold. This year, speculation chosen for this collective field is peanuts.

One of the perspectives of the group is to obtain legal recognition.

Improved seeds will be produced with the technique of CF so the resulting production can be estimated with the average yield survey in 2010. Capacity utilization in terms of area (with CF) is estimable. Standards for the use of a seed (1) hectare are such that it takes 8 to 10 kg for millet and sorghum, an average of 9 kg for maize, the amount is fixed between 20 and 16 kg kg, so an average of 18 kg.

	Surfaces of production	Surfaces of using
1ha of millet	→ 886.2 Kg	→ 98,5 ha
1ha of sorghum	→ 953.5 Kg	→ 106 ha
1ha of corn	→ 2725.8 Kg	→ 151 ha

For the project, a number of activities are important:

- 1) Training of farmers group techniques improved seed production, packaging, inventory management and resource management;
- 2) Construction of a store and buying tools;
- 3) Creating partnerships with other network groups, and groups of other rural communities in the provision of seeds;
- 4) Support the group in the process of obtaining legal recognition;
- 5) Open a savings account for the group with legal personality

Activities 1, 2 and 3 must be completed before the 2012 crop year. Funding for the training of farmers will be provided by the program. The construction of the store and buying tools will be from a loan from the financial institution partner (UIMCEC). The cost estimate and the terms of the loan will be determined later in more detail.

Activities 4 and 5 are less urgent since the group already has an account with the UIMCEC through the implementation of the CF. But their achievement is important for the smooth running of the project.

The scope of production of improved seeds will be divided into three (3) parcels, one for each of speculation. It will be a collective exploitation of these plots, the group has already initiated by the collective work. The acquisition of the seed will start following the current procedure, that is to say, by purchase with the existing partnership. The production scheduling can be done as follows for the various crops.

Table n°8:

<u>Millet</u>	Plots (ha)	Seeds produced (kg)	Market value (FCFA)	Surface of using
2012	1	886,2	354480	98,5
2013	2	1772,4	708960	196,9
2014	3	2658,6	1063440	295,4
2015	4	3544,8	1417920	393,9
2016	5	4431	1772400	492,3

<u>Sorghum</u>	Plots (ha)	Seeds produced (kg)	Market value (FCFA)	Surface of using
2012	0,5	476,75	190700	53
2013	1	953,5	381400	105,9
2014	2	1907	762800	211,9
2015	3	2860,5	1144200	317,8
2016	4	3814	1525600	423,8

<u>Corn</u>	Plots (ha)	Seeds produced (kg)	Market Value (FCFA)	Surfaces of using
2012	0,5	1362,9	545160	75,7
2013	1	2725,8	1090320	151,4
2014	2	5451,6	2180640	302,8
2015	3	8177,4	3270960	454,3
2016	4	10903,2	4361280	605,7

Source: Author

Production costs are the same as those previously calculated for the operation of an ordinary field CF. We consider the current selling price of seed (400 FCFA / kg) to estimate the value of seed produced. The following table provides an estimate of the possible benefits without taking into account the repayment of the loan.

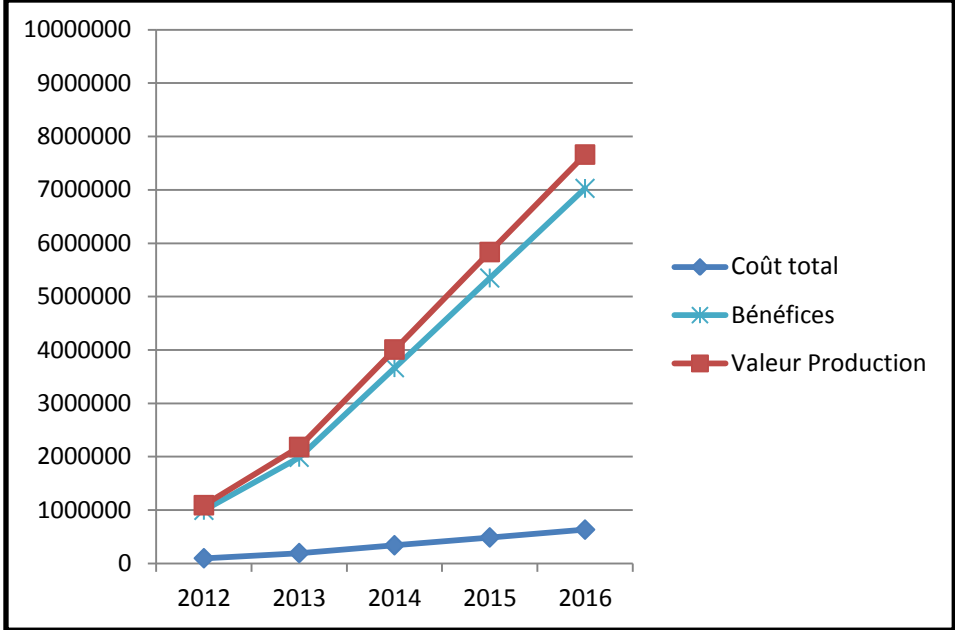
Table n°9:

Years	Surfaces (ha)				Production's value	Cost of production	Benefits
	Mil	Sorghum	Corn	Total			
2012	1	0,5	0,5	2	1 090 340	97 000	993 340
2013	2	1	1	4	2 180 680	19 4000	1 986 680
2014	3	2	2	7	4 006 880	340 400	3 666 480
2015	4	3	3	10	5 833 080	486 800	5 346 280
2016	5	4	4	13	7 659 280	633 200	7 026 080

Source: Author

The findings are that the costs of production are changing in an arithmetic progression while the sales value of production follows a geometric progression. Hence the following form for the different curves:

Graphic n°2:



Source: Author

The preceding argument assumes that the seeds are sold at current market price (400 FCFA / kg) and the part used by the group is also evaluated at the same price. But in fact, one of the main interests of the project for the entire network of CF Toubacouta is that other groups should get a discount on the price and / or reduction of payment terms. Thus, while remaining a source of income for the group seed producer, the project benefits all groups in the rural community with supply conditions easier.

Conclusion

The Conservation Farming has been a remarkable success in areas where it was introduced especially in the rural community of Toubacouta.

Tested in the Rural Community Toubacouta during the crop year 2010, the technique has proven effective in increasing crop yields in grain crops on it (millet, sorghum, maize). The number of villages involved increases so that the whole of the Rural Community will soon be integrated into the system of Conservation Farming. A network of groups of CF Rural Community already exists and the perspective is the establishment of a federation consisting of four (4) networks in the Borough.

With its ability to increase yields, agricultural productivity and production, conservation agriculture is a significant opportunity economically wherever it is practiced. It is also a major alternative in the management of natural resources and environmental conservation. Indeed, it ensures the fertility of the soil, rational management of water and helps reduce the threat of agricultural activity on the environment and the threats of climate change on agriculture.

In view of all the benefits of this type of agriculture, it is important to ensure sustainability of actions for the practice of this type of agriculture. An extension of the system to a larger scale, national, for example, can be the basis of a real revolution in the agricultural sector, and by extension, a pulse of the economy as a whole. This occurs through a process of sustainable management of natural resources. This is a real tool for sustainable development. It would be interesting to know how the conservation farming system in place could contribute to the development of Senegal in the years to come.

BIBLIOGRAPHIE

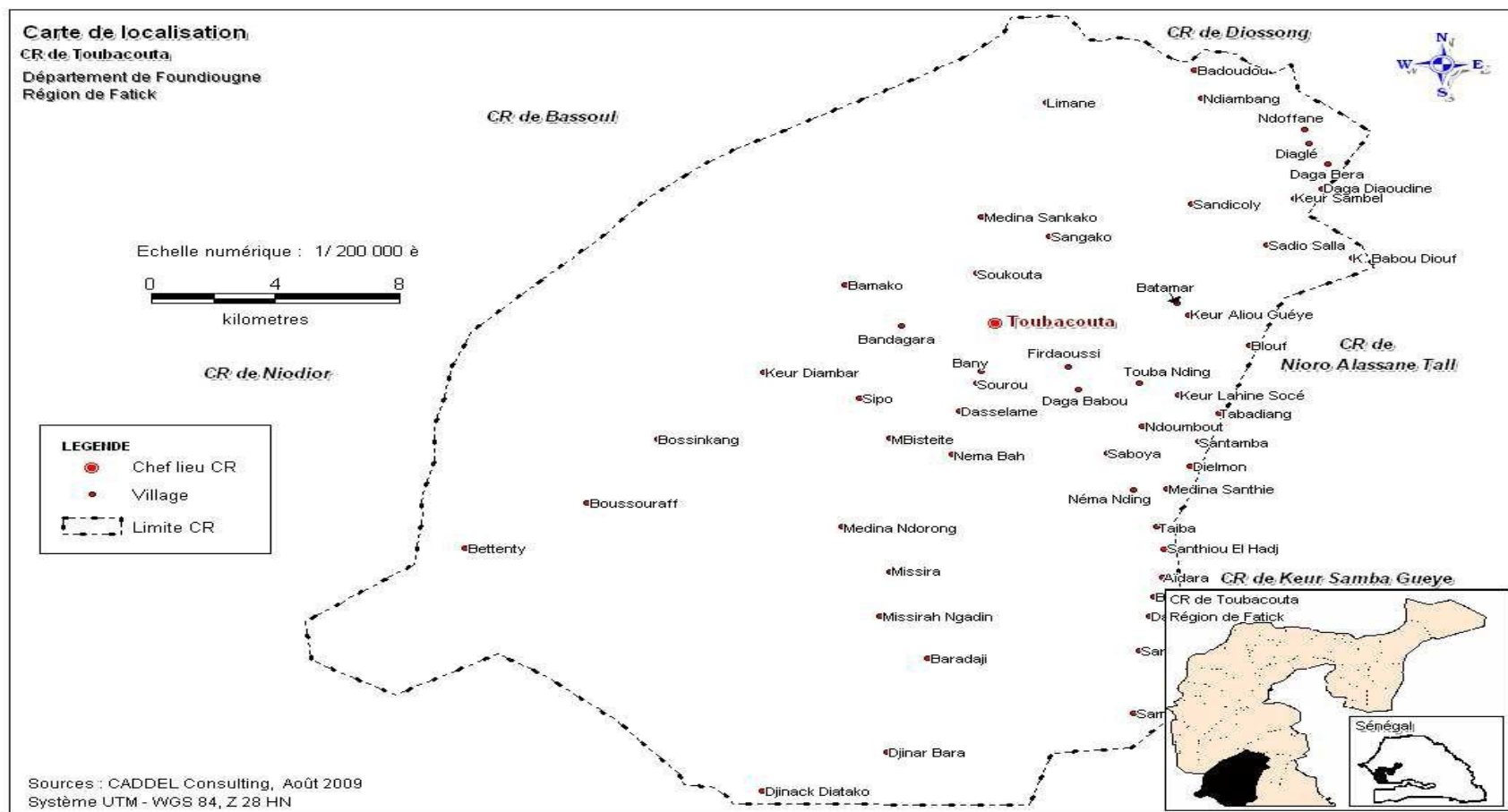
- USAID Wula Nafaa, *Stratégie de mise en œuvre du Conservation Farming au niveau des producteurs, Guide du Formateur*, version de Mars 2010
- USAID Wula Nafaa, *Evaluation à mi-parcours du Conservation Farming*, Campagne 2009-2010
- Communauté Rurale de Toubacouta, *Document du Plan de Développement Local (PLD)*, Décembre 2009
- **Sites Web :**

www.usaid.gov and senegal.usaid.gov

www.google.com

ANNEXES

APPENDIX 1: Map of Rural Community Toubacouta



Source: *Local Development Plan of Toubacouta, 2009*

APPENDIX 2: CF villages of CR of Toubacouta: Producers and Areas

Villages	Number of farmers		Surfaces	
	2010	2011	2010	2011
Némanding	17	19	13	21
Dielmon	17	21	14	36
Keur Alliou Gueye	18	22	11,75	43.5
Diaglé	16	15	15,5	22
Ndoffane		16		16
Dagadiaoudine		26		26
Sandicoloy		15		15
Medina Sangako		20		15
Bani		20		21
Santamba		20		23
Toubading		16		19.5
Taiba		14		14
Haidara		23		23
Dassilamé Socé		15		15
Samé		15		15

TOTAL	68	277	54,25	310
--------------	-----------	------------	--------------	------------

Source: Summary of the evaluation document

(2010) and field surveys

Appendix 3: Table of results of the evaluation of the technique by DRDR Fatick (Result sampling Toubacouta CR)

VILLAGE	Farmer's name	Crops	Field	Coordinates of Plots	Number of seed hole	Density	Number of ears/100 m ²	Weight of ears or panicle (gr)	Yields /ha (kg)	Observations
DIAGLE	Aliou Diaham	MIL	CF	13 850 55 016 37 413	166	16600	210	36,88	774	La masse de matière végétale nécessaire pour le paillage d'1 ha pose problème. Absence de striga au niveau CF Niveau NCF apparition de striga
	Cherif Diaham		NCF	13 850 23 016 37 485	95	9500	130	28,71	370	
	Cheikh Senghor	MIL	CF	13 857 69 016 37 195	104	10400	255	43,92	1120	Démariage non effectué. présence de striga. problème de transport de la matière organique.
	Cheikh Senghor		NCF	13 858 21 016 37 175	83	8300	154	48,69	750	
	Lamine Sarr	MIL	CF	13 854 99 016 37 563	182	18200	205	53,26	1133	
	Malick Sarr		NCF	13 850 36	103	10300	145	20,11	291	

				016 37 461						
Elhadji Cor	MIL	CF	13 85 274	120	12000	248	43,99	1090	Parcelle non démarie	
Diockel Ngom		NCF	016 37 476 13 860 51	171	17100	215	48,97	1053		
Mamadou Senghor N°2	MIL	CF	016 37 067 13 851 65	143	14300	158	26,40	417		
Ibrahima Faye		NCF	016 37 364 13 860 58	93	9300	285	30,69	875	A adopté la technique CF	
Sette Cissé	SORGHO								Parcelle abandonnée	
Moustapha Diaham	SORGHO	CF	13 851 31	109	10900	198	83,29	1694		
Mbaye Mbodj		NCF	016 376 31 13 858 86	187	18700	449	27,79	1248	Démariage faiblement effectué ; grattage avant semis ; apport de matière organique	
Ibrahima Faye	SORGHO	CF	016 36536 13 86013	139	13900	389	23,93	931		
		NCF	016 30702 13 86121	280	28000	430	21,94	943		
Ndiaga Faye	SORGHO	CF	016 37111 13 85819	112	11200	180	21,72	391	Beaucoup de pieds	

	Diockel Ngom			016 36916						manquants, provoquant une faible densité
			NCF	13 85876 016 37076	109	10900	121	5,5	66	
	Modou Sarr	MAÏS	CF	13 84750 016 37540	117	11700	32	xxxxx	xxxxx	Semis tardif, mauvaise densité, épis minces. Résultat nul
			NCF	13 85874 016 37007	131	13100	108	50,41	544	
Philippe Faye										
Keur Aliou Gueye	Mamadou SENE	SORGHO	CF	13 78429 016 41440	92	9200	290	27,51	798	Fort tallage.
			néant	néant						
	Cheikh Gning Mamadou Gning	MIL	CF	13 78149 016 41478	124	12400	246	40,25	990	Apport de beaucoup de matière organique
			NCF	13 78 125 016 41046	59	5900	176	30,36	534	
	Youssoupha BA Amadou Gadiaga	MIL	CF	13 78075 016 41046	135	13500	229	39,4	902	N'a pas respecté les recommandations jusqu'à terme
NCF			13 78062	184	18400	185	40,10	742		

				016 41136						
Diégane Sarr	MIL	CF	13 77652	186	18600	469	25,30	1186	Bon écartement, pas de démariage, parcelle propre	
Diégane Sarr			016 41046							
			13 77712	161	16100	265	32	848		
			016 40884							
Mamadou Gning	MIL	CF	13 79336	257	25700	212	33,32	706	Parcelle très mal très mal entretenue, non respect des recommandations.	
NEANT				016 40774						
		NEA NT								
Aliou Bop	MAÏS	CF	13 79120	209	20900	222	?		Semis tardif ; le grattage et le parcage ont été faits	
Aliou Bop				016 40701						
		NCF	13 79 115	249	24900	193	?			
			016 40770							
Lamine Bop	MAÏS	CF	13 79 077	257	25700	212	128,40	2722		
Lamine Bop				016 40774						
		NCF	13 79038	111	11100	98	98,7	967		
			016 40793							
Mamadou Gning	MIL	CF	13 79336	112	11200	158	30,36	480	Parcelle très mal entretenue, non respect des consignes	
NEANT				016 41435						

			NEA NT	NEANT						
	Ibrahima Sakho	MAÏS	CF	13 78227 016 40561	292	29200	306	102,29	3130	Respect des consignes, bon comportement des cultures. Le site abritant la parcelle NCF a bénéficié de l'effet du pacage, du labour et de tout le paquet technique.
	Ibrahima Sakho		NCF	13 78 245 016 40566	332	33200	347	105,5	3660	
Diélmon	Insa Diamé	SORGHO								Parcelle au stade début épiaison
	Issa Diamé	MIL	CF	13 72324 016 40421	124	12400	303	35,05	1062	Retard dans la mise en place de l'engrais. Autre contrainte : manque de moyen pour le transport du terreau.
	Mohamet Diamé		NCF	13 72325 016 40373	115	11500	172	12,24	211	
	Ismaila Demba		CF	13 72396 016 40039	198	19800	363	30,10	1093	

Abdou Khadre Sonko	MIL	NCF	13 72481 016 39984	165	16500	226	18,91	423	
Youssoupha Sonko	MAÏS	CF	13 72566 016 39984	376	37600	266	103,35	2945	Champ très amandé et bien entretenu.
Ibrahima Diamé		NCF	13 72621 016 40695	469	46900	449	30,5	1369	Forte densité, épis très petits pas de démariage ou éclaircissage.
Bécaye Sarr	MIL	CF	13 73579 016 40828	116	11600	205	49,19	1008	Parcelle bien entretenue
Bécaye Sarr		NCF	13 73988 016 40567	185	18500	385	25,46	980	
Mamadou Senghor	MIL	CF	13 72676 016 41898	94	9400	126	37,61	474	Parcelle mal entretenue
Mahécor SARR		NCF	13 72658 016 41897	215	21500	240	21,05	505	Parcelle mal entretenue
Gorgui Sonko	MIL	CF	13 72676 016 41895	193	19300	250	34,31	858	Parcelle sur forte pente ; resemis.
Gorgui Sonko		NCF	13 72658 016 41897	164	16400	153	20,99	321	

Issa Diamé	MAÏS	CF	13 72544 016 42078	144	14400	198	119,59	2368	
		NEANT	NEANT						
Paul Thiaw	MAÏS	CF	13 72 569 016 42200	310	31000	286	108,82	3112	Remplace Moussa Camara ; parcelle très mal entretenue
		Moussa Doumbouya	NCF						
Aliou Badara Ngom	MAÏS	CF	13 72989 016 40393	168	16800	213	97,58	2078	
		NEANT	NCF						

Source: Regional Rural Development Fatick, 2010