



# Irrigation for the Development of Agriculture and the Improvement of the Socio-Economic Conditions of Women in Senegal: Case of the PARIIS Project in the Fatick Region

Mamadou Moustapha Mbaye<sup>1</sup>, Maimouna Sow Niang<sup>2</sup>, Aly Sané Niang<sup>3</sup>

<sup>1</sup>National School of Agriculture (ENSA of Thies, Senegal), Thies, Senegal

<sup>2</sup>ISM de Thies, Thies, Senegal

<sup>3</sup>Project PARIIS, Fatick, Senegal

Email: mmoustapha.mbaye@ensa.edu.sn, maimounasow28@gmail.com, alysaneniang@gmail.com

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## Abstract

The paper investigates the role of irrigation in developing agriculture in Senegal, focusing on the PARIIS project in the Fatick region. It assesses the added value of irrigation by examining agricultural production levels and income generated among primarily female beneficiaries. The study finds that irrigation significantly increased production and consequently raised the income of all producers. Additional benefits include time savings, improved health conditions, and the ability for beneficiaries to engage in other activities. It appears from the study that with the introduction of irrigation, the areas saw their production increase substantially, sometimes going from simple to quadruple. Consequently, we observed an increase in income for all producers. In addition to these quantitative advantages, we note other equally important advantages such as the notable time saving caused by considerably reduced plant watering time. Indeed, the beneficiaries, before irrigated systems, spent practically the entire day and sometimes the night drawing water from wells to irrigate the fields. This time saving now allows them to devote themselves to other activities, particularly family-related and sometimes lucrative. Their state of health has improved at the same time, which contributes to better living conditions. This situation does not exclude difficulties that must be resolved to get the most out of the developments. We note the need to strengthen the capacities of farmers in order to better manage technical routes, the absence of storage infrastructure to ensure good conservation of crops, the non-availability of quality fertilizers on time, difficulties in marketing process, etc. Finally, to strengthen the achievements, recommendations are made to the beneficiaries, projects and

programs but also to the State.

## Subject Areas

Economics, Entrepreneurship

## Keywords

Agriculture, Irrigation, Woman

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## 1. Introduction

In Senegal, the economic development of water and land resources has been on the agenda since the 1940s, and the first actions began in this direction before and during the first years of independence. The trend deterioration in climatic conditions observed from the beginning of the 1970s led the Senegalese authorities to adopt irrigation as a preferred axis for intensifying and securing agricultural production [1].

Since then, the development of irrigation has been considerably strengthened under the leadership of public authorities. The areas thus developed, all forms of irrigation combined, are spread over the valley of the Senegal River and its hydro-graphic dependencies (75,600 ha), the Lower and Middle Casamance (15,000 ha secured against saline intrusion), the water table phreatic Niayes (10,000 ha), the Anambe valley (3580 ha taking into account the recent extension of the initial perimeter to 2500 ha), eastern Senegal (600 ha), and the peanut basin (for memory) [2].

In the 2000s, the State of Senegal launched the National Retention Basin Program with the main objective of mobilizing the large quantities of water lost through runoff during the three months of the rainy season [3].

Other projects and programs to mobilize water for agricultural purposes have emerged and significant human and financial resources have been injected into the sub-sector with still mixed results. Indeed, the objective of food self-sufficiency still remains a challenge for the State of Senegal. It is therefore urgent to significantly strengthen the level of agricultural production which will only be achieved through irrigation because the three months of rainy season on average cannot make it possible to achieve agricultural development objectives [4].

In many rural areas of Senegal, women are traditionally involved in small-scale agriculture and household food production. They often manage vegetable gardens and are responsible for feeding the family, which might explain their primary involvement in these irrigation projects.

To better guide interventions in the irrigation sub-sector and meet agricultural production needs, it is imperative to identify the real contribution of the practice of irrigation to the development of agriculture in Senegal [5].

So, it is important to know how the practice of irrigation contributes to developing

agriculture in Senegal? What are the advantages of setting up irrigated systems for the rural populations benefiting from the PARIIS project, particularly in Toubacouta in the Fatick region?

### 1.1. Research Objectives

#### **Main objective:**

Our research aims to contribute to the development of agriculture in Senegal through a study on the importance of irrigation: case of the PARIIS project in the Fatick region.

#### **Specific objectives:**

More specifically, this will involve:

- Present the different irrigation systems practiced within the framework of the PARIIS project and their advantages.
- Evaluate the contribution of irrigated systems in increasing agricultural production.
- Present the contribution of the practice of irrigation in increasing the income of producers in the Fatick region.

### 1.2. Presentation of the Framework and Scope of the Study

The study is carried out at the level of the irrigated areas carried out by the PARIIS project in the region of Fatick in Senegal, precisely in the department of Foundiougne, commune of Toubacouta. These are small, irrigated areas ranging from 1 to 5 ha occupied mainly by women. These areas have drip or sprinkler irrigation systems powered by solar systems.

The Regional Support Project for the Sahel Initiative (PARIIS), is a regional project coordinated by CILSS which is implemented in 6 Sahel countries, namely Burkina Faso, Mali, Niger, Mauritania, Chad and Senegal. PARIIS Senegal is under the supervision of the Ministry of Agriculture and Rural Equipment. It started at the end of 2018 and will end in 2024. PARIIS aims to improve the capacity of stakeholders to develop and manage irrigation and increase irrigated areas by following a regional “solutions”-based approach in participating Sahel countries [6].

### 1.3. Announcement of the Plan

In addition to the introduction and conclusion, this document is subdivided into three parts. The first part presents the methodology used to conduct this study. The second part consists of the analytical framework where the data from the field surveys are analyzed. Conclusions drawn and recommendations made in the third part.

## 2. Methodology

To achieve these objectives, the following methodology is adopted.

- Preliminary documentation work on the PARIIS project, partner projects, DBRLA, irrigation and agriculture in general is being done. ISM dissertation

works as well as publications in the field are explored, as is the Internet.

- The collection was done using an interview guide, a questionnaire and some observations made in the field. The interview guide made it possible to collect data on the project and the types of irrigation practiced as well as their advantages. The questionnaire was designed using Sphinx software, following a prospective phase in the field. It is structured around the following axes: the evolution of production after the establishment of irrigated systems, the income of producers emanating from the exploitation of irrigated areas, the other advantages linked to the practice of irrigation as well as the difficulties encountered in perimeter management.
- We opted for semi-structured interviews in order to answer well-targeted questions while allowing the interviewees to develop certain aspects of the question which can be useful in the search for information.
- The perimeters which are retained within the framework of this study are those which were carried out by the PARIIS project in relation to the DBRLA in the Fatick region as part of its anchoring. The sites are Keur Aly Gueye and Keur Samba Gueye in the commune of Keur Samba Gueye, Nemah Ba, Dassilamé Serrere, Batamare, Santhie Bera in the commune of Toubacouta. Failing to have the president of the group benefit from the development, we set about talking with members of the group of beneficiaries.

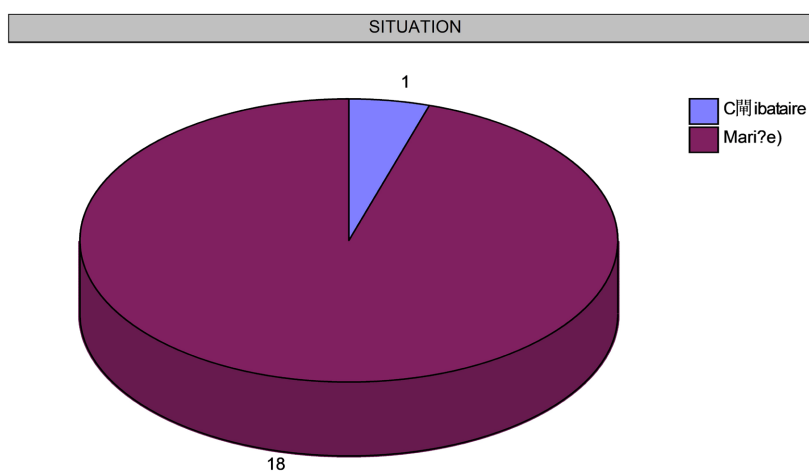
### 3. Analysis and Interpretation of Results

In this chapter, the following sections are discussed based on the questions asked.

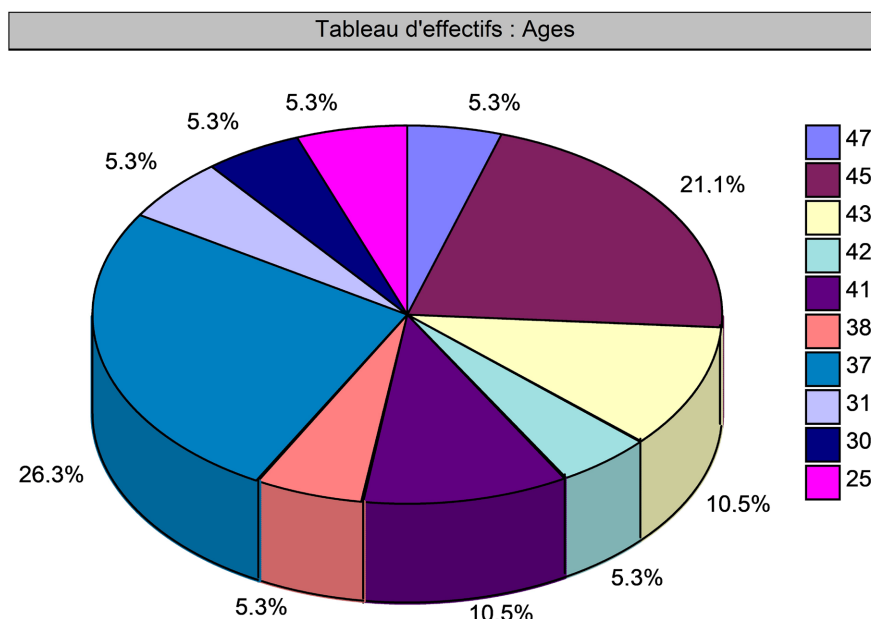
#### Section 1: Producer profile

It appears clearly from **Figure 1** and **Figure 2** that the beneficiaries of the arrangements are essentially married women of fairly mature age, which gives them a lot of family responsibilities, hence the pressing need to carry out lucrative activities to support themselves. Certain family needs.

In fact, 84% of beneficiaries are over 35 years old and 90% are over 30 years old. The majority of women are married as shown in **Figure 1**.



**Figure 1.** Marital status.



**Figure 2.** Age distribution.

## Section 2: contribution of irrigated systems to increasing production

The types of irrigation developed are classified into five categories as presented in **Table 1** below:

**Table 1.** Types of irrigation practiced within the framework of PARIIS.

Kind	Irrigation systems	Description
1	<b>Development of lowlands and controlled recession</b>	Improved rainwater harvesting based on partial water control using small levees, gates and access structures in low-lying areas, including lowlands and flood plains.
2	<b>Small private individual irrigation</b>	Small-scale private irrigation systems for individuals or small groups of producers, involving the presence of pumping equipment and the distribution of water through different types of pipes or conduits.
3	<b>Community irrigation</b>	Small-scale community irrigation for villages or large producer groups formed into user organizations, managing pumping equipment and water distribution through different types of pipes or conduits, as well as access structures.
4	<b>Large public irrigation</b>	Large-scale irrigation schemes managed by public authorities, usually originating from large rivers regulated by dams, and involving a combination of pumping stations, sluice gates, large pipe and drainage systems, roads and service and a complex governance structure based on user organizations.
5	<b>Commercial irrigation through public-private partnership (PPP).</b>	Medium- or large-scale irrigation plans based on a partnership between the government, a private entity and communities near the irrigation system to develop and manage the system (meeting the same technical specifications as Type 4).

Types 1, 2 and 3 are implemented with PARIIS Senegal. With type 1, we have partial water control with the development of lowlands most often for rice growing. Types 2 and 3 mainly mobilize groundwater through boreholes and the perimeters are irrigated by sprinkling or drip with a solar system. With these types,

we have water control even if we note better efficiency of drip irrigation compared to sprinkling, which affects crop yield. In addition, with drip fertilization is provided directly by the irrigation water. Clearly, we note the best yields on micro-irrigation systems.

At the level of irrigated areas, the study shows that the crops most practiced by producers are onions at almost 95%, potatoes at almost 90% and tomatoes at 100% as indicated in **Table 2**.

**Table 2.** Speculations practiced in the perimeters.

What are the different cultures	Nb. Cit.	Fréq.
Onion	18	94.7%
Tomato	19	100%
Patato	17	89.5%
Others	13	68.4%
Total	19	

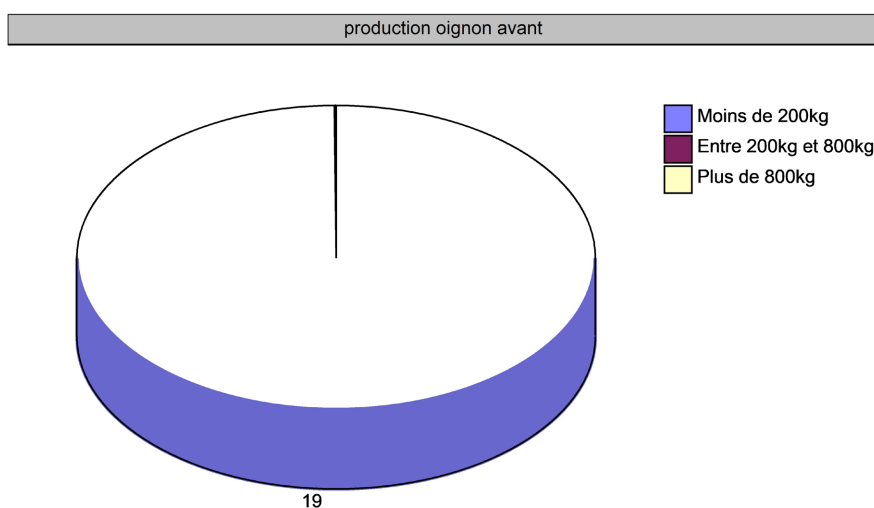
Essentially, in addition to these three speculations, other cultures are presented at almost 70% showing a certain diversity in the choices.

#### Subsection 2.1: onion production

For onions, **Figure 3** and **Figure 4** show the production level before and after the practice of irrigation. We note that all beneficiaries (100%) saw their production increase from less than 200 kg to more than 800 kg, an increase of more than 200%. These results are attributable to the systems put in place which improved yields but also strengthened the plantings with the availability of water resources.

#### Subsection 2.2: tomato production

The situation for tomatoes is identical to that of onions with the same levels of increase as presented in **Figure 5** and **Figure 6**:



**Figure 3.** Onion production before irrigated systems.

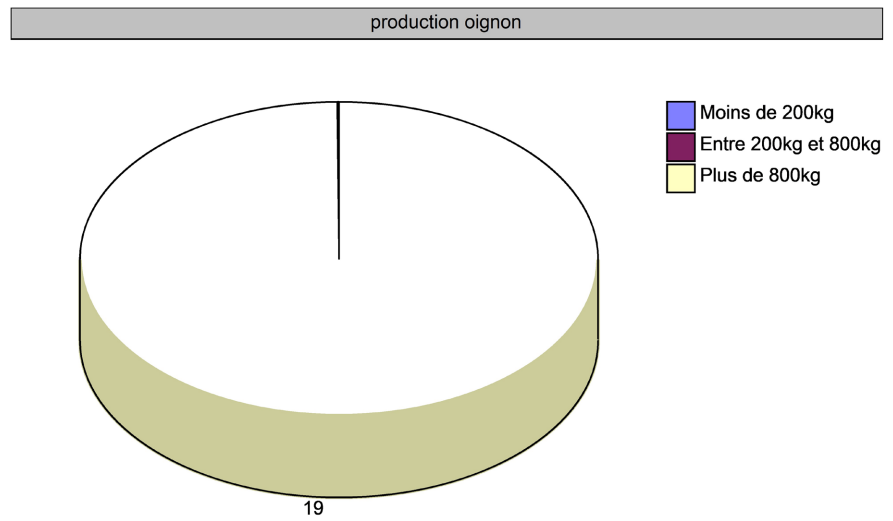


Figure 4. Onion production with irrigated systems.

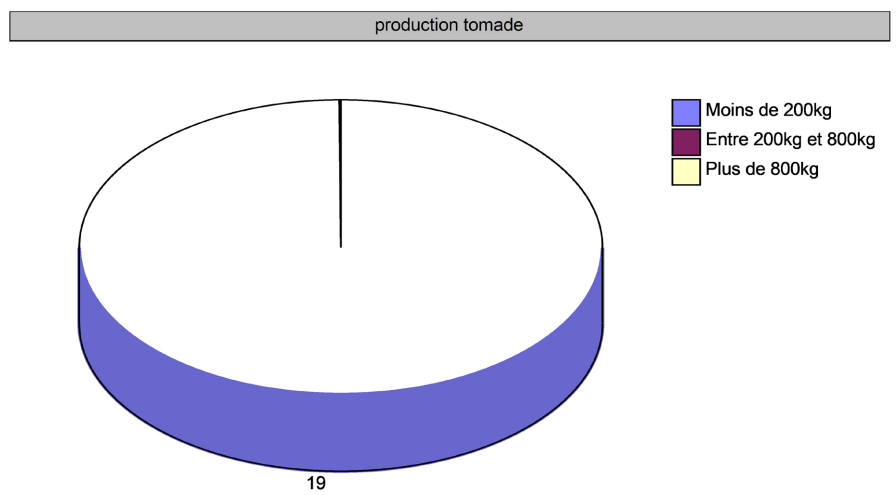


Figure 5. Tomato production before the irrigated system.

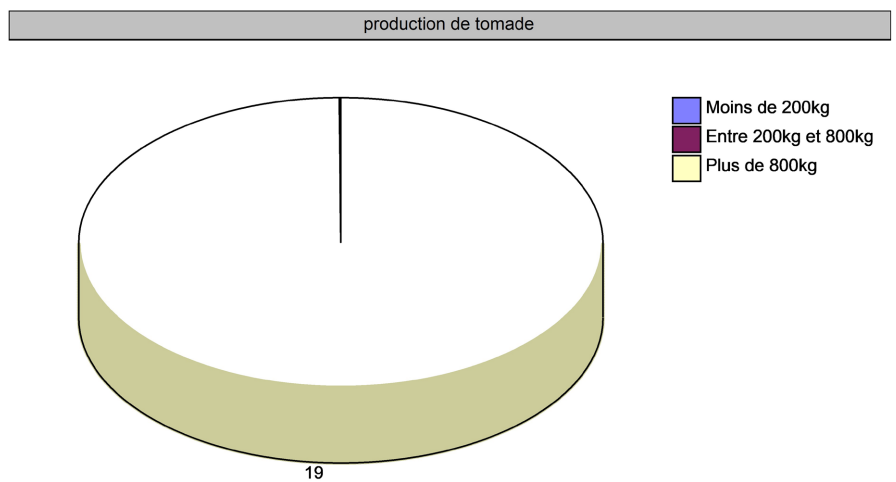
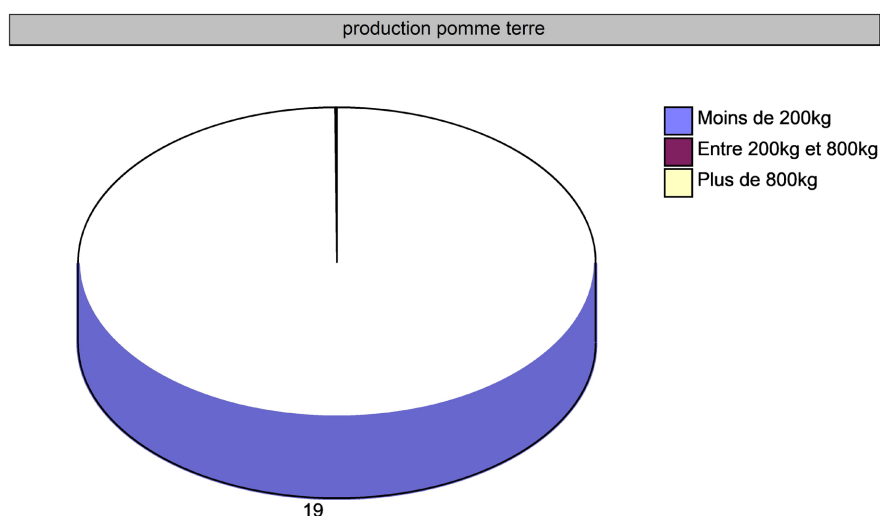


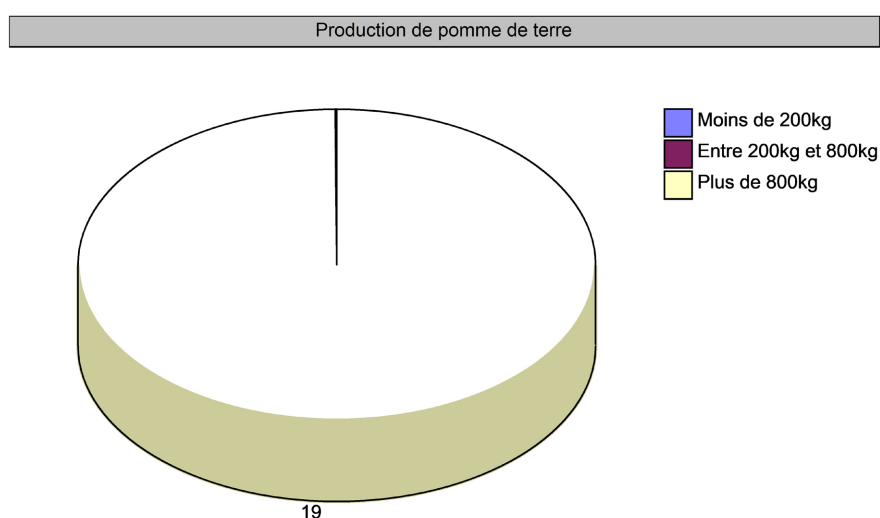
Figure 6. Tomato production with the irrigated system.

### Subsection 2.3: potato production

The production results illustrated in **Figure 7** and **Figure 8** show that the same is true for potatoes.



**Figure 7.** Potato production before the irrigated system.



**Figure 8.** Potato production with the irrigated system.

We note that the production of all speculations has experienced a substantial increase with irrigated systems. They go from single to quadruple and sometimes more. The determining factors in this increase are the availability of water and the induced effects.

Indeed, due in particular to the availability of water, these systems have not only increased the land occupancy rate which has gone from 30% to nearly 97% according to the Dassilamé Serere Agricultural Council. However, several speculations are introduced including those which were the subject of the study, namely tomatoes, onions and potatoes. Indeed, nearly 70% of those interviewed practice

other cultures as shown in **Table 2**.

We can say that the establishment of irrigated systems has made it possible to strongly strengthen production for all crops.

### **Section 3: contribution of irrigated systems to increasing producers' income**

The main observation is that the income of the beneficiaries of the developments has experienced a substantial increase, explained by the increase in the areas sown with land occupancy rates going from simple to triple and higher yields linked to the practice of these modern irrigated systems. All producers according to the results of the study recorded in **Table 3** below affirm without hesitation that their income has increased with the practice of irrigation.

**Table 3.** Proportions of increase in income.

Increased revenue	Nb. cit	Fréq
Yes	19	100%
No	0	0.0%
Total OBS.	19	100%

**Table 4** and **Table 5** give the income levels before and after the establishment of irrigated systems. It appears that for the previous situation, the large majority of producers almost 95% had an annual income of less than 150,000 F while the new perimeters brought the level to more than 500,000 F. Which undoubtedly constitutes a notable advance in the level of income generated by the practice of agriculture. This situation, if strengthened, can contribute significantly to the fight against poverty in rural areas.

**Table 4.** Income levels with irrigated systems.

Annual revenues (FCFA)	Nb. Cit.	Fréq
Less than 150,000	0	0%
Between 150,000 et 500,000	0	0%
More than 500,000	19	100%
Total OBS.	19	100%

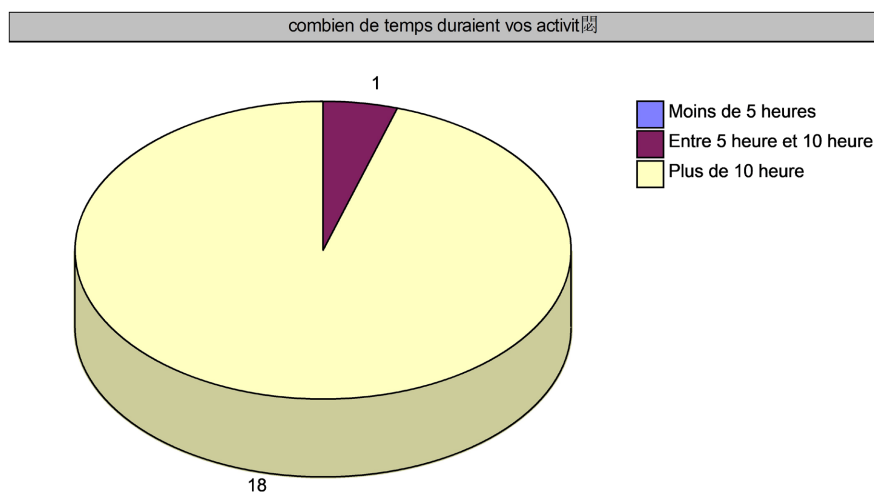
**Table 5.** Income levels before irrigated systems.

Annual revenues (FCFA)	Nb. Cit	Fréq
Less than 150,000	18	94.7%
Between 150,000 et 500,000	1	5.3%
More than 500,000	0	0%
Total OBS.	19	100%

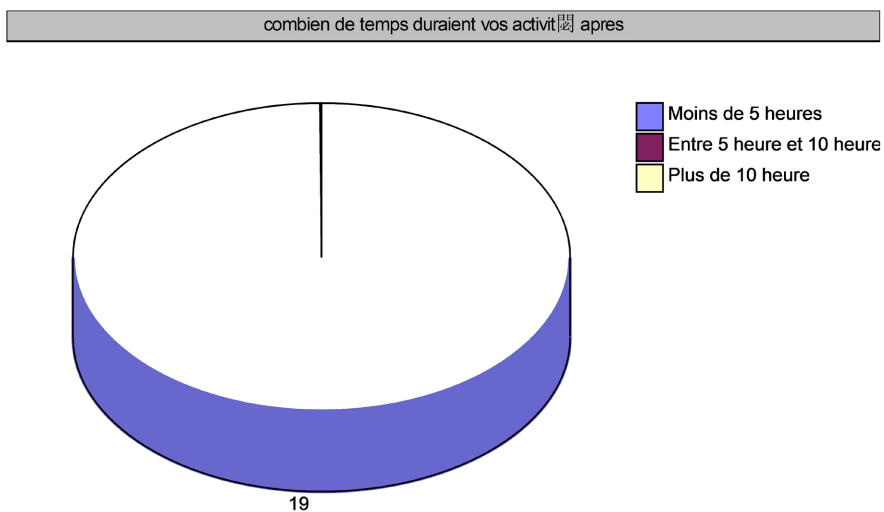
### **Section 4: other benefits of practicing irrigation**

In addition to the quantitative advantages linked to the increase in production

and income, it has been established that other advantages including particularly the substantial time saving noted for the benefit of producers made up mainly of women; this new situation gives them a lot of time to devote themselves to other family activities and sometimes lucrative ones. All the women with these irrigated systems spent practically the whole day and sometimes the night drawing and watering the crops and with the new arrangements, the watering time is considerably reduced from effectively more than 10 hours per day to less than 5 h as shown in **Figure 9** and **Figure 10** below.



**Figure 9.** Watering time before irrigated systems.



**Figure 10.** Watering duration time with irrigated systems.

The irrigation system is often managed by a single person responsible for opening and closing the valves at fairly specific times and watering rarely exceeds two hours unlike previous systems where all the women were almost mobilized almost the entire time. Day to draw water from wells using pulleys. A situation which had the consequence of exhausting them and thus affecting their health with less than

encouraging results. Today, they take advantage of their short time spent in the fields to engage in other activities that they could not do before. They have more time to take care of their home, go to the market, participate in family ceremonies and even engage in parallel activities that provide them with additional income.

#### **Section 5: difficulties encountered**

The perimeters (See **Appendix**) put in place have largely contributed to improving the conditions of beneficiaries, but their management faces a certain number of difficulties summarized as follows.

- The lack of mastery of technical routes by producers; in fact, yields are sometimes affected by untreated diseases or other technical factors.
- Lack of quality inputs within the required time frame; very few producers benefit directly from seeds and fertilizers subsidized by the State while respecting the appropriate timing to respect crop cycles.
- Once the products are available, there is a glaring lack of storage stores and marketing channels in order to sell these products in the best conditions and maximize income for the benefit of producer groups.

## **4. Conclusions and Recommendations**

This study sought to show the advantages of irrigated systems introduced into the agricultural practices of women in the Fatick region of Senegal. We note that they not only make it possible to significantly increase productivity by providing water and nutrients directly to the plant, but they also provide other non-quantitative advantages, in particular the time savings generated by the considerable reduction in processing time. Watering is a situation which allows beneficiaries to devote themselves to other occupations (family, lucrative activities, etc.) and to take better care of their state of health. Indeed, the results of the surveys show that all the producers interviewed saw their production increase from simple to quadruple and sometimes more for a single crop cycle. Irrigation allows two to three cycles annually, these already substantial productions can be doubled or tripled, which has the effect of considerably increasing income. All beneficiaries of the developments therefore saw their income increase significantly in proportions ranging from less than 150,000 F to more than 500,000 F.

As limitations, we can highlight the difficulties of beneficiaries in mastering the data resulting from their production and the income generated. It is often necessary to use an intermediary such as a CAR to obtain exhaustive data.

This study gives some elements of appreciation in relation to the added value of irrigated systems in the development of agriculture but to validate these results it is necessary to carry out the study on a larger scale.

### **Recommendations**

To give more scope to the advantages of irrigation, we can remember that it is appropriate to formulate recommendations to the key players in the sub-sector, namely producers, projects and the State.

To the producers:

- Take ownership of the developments by formulating their investment needs and monitoring the work.
- Organize into works management committees to sustain the developments and organize marketing.
- Train to face the challenges of technical, organizational and financial management of the areas.

Regarding development projects:

- Involve the beneficiaries of the developments from the choice of sites to management.
- Systematically plan capacity building programs for beneficiary producers to facilitate the management of areas, particularly in the mastery of technical routes.
- Provide groups with a stock of spare parts for irrigation equipment to compensate for certain minor damages.
- Build production storage stores to minimize post-harvest losses but also to ensure good sales of products.
- Support beneficiaries to integrate markets for the marketing of production.

Towards the State:

- Make quality inputs available within the required time frame to guarantee good production.
- Establish a good advisory support system for the benefit of producers.
- Facilitate access to campaign credit through a good network of decentralized financial systems and agricultural banks.
- Subsidize irrigation equipment to make it accessible.
- Increase agricultural development projects for the benefit of young people and women in order to exploit the irrigable potential of Senegal.

## Conflicts of Interest

The authors declare no conflicts of interest.

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**Appendix: Images of the Perimeters**

