Assessing household vulnerability to food insecurity and adaptive capacity in a large-scale irrigation scheme

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Introduction

Since the severe drought of the 1970s, the implementation of large irrigation systems has been seen in Sahelian countries as an effective agricultural policy to increase crop production and promote rural development. However, despite their significant contribution to agricultural production, these systems generate social and economic risks (Hussain, 2007), which have adverse impacts on the beneficiary people's living conditions. This study focused on the case of the Bagré irrigation system in Burkina Faso. A large dam was built in 1994 to produce electricity and develop irrigated rice cultivation in order to strengthen household livelihoods. Nearly 3380 ha were developed and allocated to over 3000 farmers to grow mainly rice in two cropping seasons a year. Extensions of 16000 ha are planned and will affect thousands of families living in the surrounding area. In this context, **this study sought to assess the impact of the existing irrigated perimeters on household food insecurity and vulnerability.**

Methodology

- **Food security analysis**

In January 2017, surveys of 180 irrigating households (irrigated area) and rainfed households (surrounding area), selected randomly in 6 villages, were conducted to collect data related to resource endowments, cropping activities, and off-farm activities.

✓ **The farm households were grouped into farm types according to their resource endowments using cluster analysis**.

✓ **For each farm type, we estimated two food security indicators (CILSS, 2004):**

- The annual cereal consumption per household member which is compared to the CILSS [2] indicator of 203 kg/adult/year.
- The daily caloric intake (including non-cereal foods) per household member which is compared to the threshold of 2200 kcal/adult/day.

- **Vulnerability analysis**

Temporal data (rainfall, productions, and prices) were analyzed, and focus group discussions were held in the six villages in later 2017 to identify risks and shocks on household activities (Choularton and al. 2015) and their coping capacities.

✓ **We assessed the household vulnerability to food insecurity in the form of crop losses associated with the shocks on their cropping activities (Seaman and al. 2014).**

- For each shock, we simulated an ex-ante effect of a percentage decrease in grain productions (millet, sorghum, maize, and rice). The reductions in cereal productions were estimated through the group discussions and secondary data analysis.

[2] *Comité inter-États de lutte contre la sécheresse au Sahel*

Results

- **Food security has improved thanks to increased rice productivity (Fig. 1), resulting from cropping intensity and intensification.**

Irrigating households

- All household types met their basic cereal needs (Fig. 1), of which 46% with their productions only (types 1 & 5), and 54% with supplement grains purchased on markets (types 2, 3 & 4).
- Irrigated rice production was the primary source of food (at least 40% of the consumption) and highly determined the household food security.

Rainfed households

- 25% of the households (type 8) were unable to meet their basic cereal needs (consumption 15% lower than 203 kg) (Fig. 1). Most of them (86%) relied on markets to supplement their needs (types 6, 8 & 9).
- Maize was the primary source of food (at least 55% of the consumption).

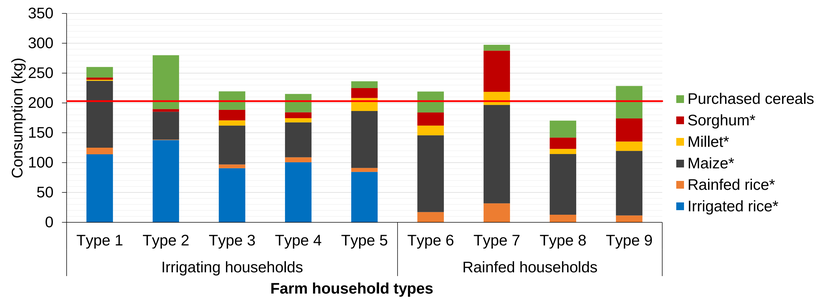

Fig. 1: Annual cereal consumption per household member (in kg).
Notes: the asterisks are self-consumptions. The red line is the CILSS indicator of 203 kg/adult/year. Source: fieldwork

- **All household types were able to satisfy their basic caloric needs (Fig. 2). However, diet diversities were low (Table 1).**

- In the irrigated area, the shares of cereals in caloric intakes (an indicator of diet diversity) were high (87-93%) and showed uniform diets (Table 1), with the overconsumption of rice at the expense of non-cereal foods.
- **The promotion of mono-cropping rice has led to changes in eating habits and may have adversely affected the household nutritional status.**
- In the rainfed area, the shares of non-cereal foods were higher than in the irrigated area but lower than the CILSS standard (24%), except for type 6 (Table 1).

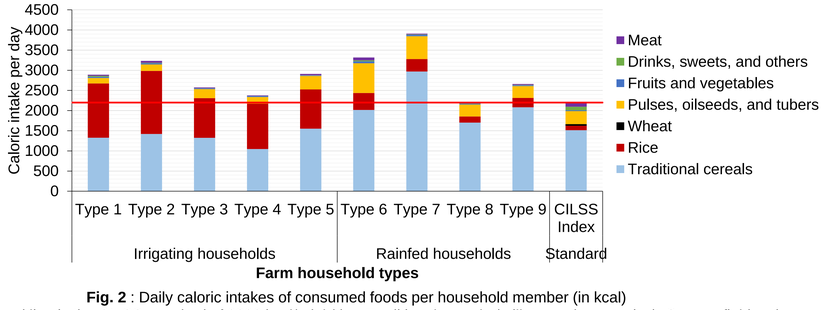

Fig. 2 : Daily caloric intakes of consumed foods per household member (in kcal)
Notes: the red line is the CILSS standard of 2200 kcal/adult/day. Traditional cereals (millet, sorghum, maize). Source: fieldwork

Table 1 : Shares (%) of the caloric intakes of cereals and non-cereal foods in the total consumptions *(Source: fieldwork)*

	Irrigating households					Rainfed households				Standard
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	CILSS
Cereals	**93**	**92**	**90**	**91**	**87**	**73**	**84**	**84**	**87**	**76**
Traditional cereals	46	44	51	44	53	61	76	77	78	69
Rice	47	48	38	47	33	13	8	7	9	5
Wheat	0	0	0	0	0	0	0	0	0	2
Non-cereal foods	**7**	**8**	**10**	**9**	**13**	**27**	**16**	**16**	**13**	**24**

- **Despite the control of climate shocks, the irrigating households remained vulnerable to a new range of risks: the lack of fertilizers, problems of selling rice, granivorous birds, the wind and cold.**

- The households who lack inputs are unable to follow the optimal calendars of the seasons. Those who cannot harvest before December risk yield losses of up to 50-60% due to the wind/cold (Segda and al. 2004; Group discussions).
- A 50% decrease in rice production could reduce food availability and, thus, self-consumption. Nearly 69% of the households (types 3, 4, & 5) are likely to move into food insecurity (Fig. 3). Types 1 & 2 could still meet their needs through markets.
- Besides, coping capacities were low for the irrigating households because of the lack of non-farm jobs, low livestock, and rice mono-cropping.

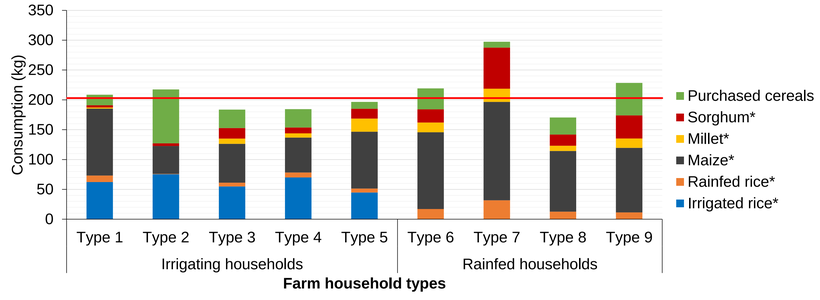

Fig. 3 : Effects of a 50% decrease in rice production on household food consumption. Source: fieldwork

Conclusion

We assessed the Bagré irrigation system's impact on the beneficiary household food insecurity and vulnerability, using two indicators. The results showed an improvement in food security thanks to the increase in rice productivity. However, diet diversities appeared to be low, mainly in the irrigated area and may have damaged the farm household nutritional status. Despite access to irrigation, the irrigating households remained vulnerable due to the emergence of a range of rice farming risks and low adaptive capacity.

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