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Impacts of cultivations of oasis-basins on food safety of populations: A case study of the basin of Guirsilik in the township of Goudoumaria

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Abstract

In the township of Goudoumaria, the oasis basins are areas of high agricultural value, although these basins are nowadays mostly degraded or in the process of being degraded, due to a combination of human practices and the effects of climate change. The main objective of this study is to understand the socio-economic and food impact of farming in the basin of the village of Guirsilik. To this end, a methodological approach comprising both theoretical and practical aspects is adopted. The theoretical approach, which consisted of a literature review, revealed that the basins are the main sources of income for the people of the commune of Goudoumaria. Individual and focus group surveys were carried out among farmers to collect data and measure the economic and financial profitability of farming in the Guirsilik basin. Short-cycle crops (onions and cabbage) have proved to be more profitable than long-cycle crops such as manioc and sugar cane. The majority of agricultural products in the basin is used for own consumption

(70%) rather than for sale (30%), and around fifty-seven percent (57%) of the produce sold is sold on local markets. Despite its importance for the survival of the population, this basin remains under constant threat of silting up, as well as flooding, depending on the year.

Keywords: Oasis basin, Crops, Food security, Goudoumaria, Niger

Introduction

The questions linked to food safety constitute in general one of the major concerns in the developing countries (DAN HABOU. S, 2008, translation is mine). In Niger, agriculture is one of the main contributors to food safety and house incomes. But, the last decades, the production of pluvial cultivations, which formerly exceeding until the 80s has structurally become deficient and assures rarely the food safety of the populations. For that, it exists a space between the food needs of a growing population and agricultural production. However, natural and anthropic constraints have led to the degradation of the productive potential and to the gradual diminution of agricultural performance (SDR, 2006 KANEMBOU. L, 2006, MAMAN. I, 2015, translation is mine). In this context, the agricultural activities are only rentable in the most humid areas whose basins nowadays represent a natural trump susceptible to assure the food safety of the populations in a context marked with the persistence of climate conditions shortly favorable to the rural world activities (KANEMBOU. L, 2006). In Niger, the basins of Mangan, in the region of Diffa (South-East of the country) dispose enormous potentialities in terms of agricultural production whose potential varies following the position of the basin and the level of its phreatic tablecloth. They constitute the natural resources that support the Agro-Forestry-Pastoral production of the zone and are sources of food productions and incomes for the local populations. The basins are the only resort for the survival of the South-East Nigerien populations via their intensive putting into worth (JAHIEL. M, 1998, AMBOUTA. K.J.M and al, 2005, KANEMBOU L, 2006, TYCHON B & AMBOUTA K. J.M, 2009, MALAM ASSANE, M, 2021). Thus, the putting into specificity of Oasis-basins is of an increasing interest by looking at the position held by the agricultural production in the protection of the agricultural houses (MALAM BOUKAR A.K, 2016). In the township of Goudoumaria (Region of Diffa, South-East of Niger), the agricultural activities are the main components of the means for the subsistence of the populations. However, the fact that the more and more generalized decrease of the agricultural production that would be linked to the effects of climate change combined with demographic growth in that township, the pluvial cultivations do not assure since some years, food equilibrium of the populations. For that matter, the populations living near to

the basins deploy their vital efforts in exploiting the basins to extenuate the deficit linked to the decrease of the production of pluvial cultivation (JAHIEL. M, 1998, OZER.P and al, 2005, 2009, 2017, INS, 2012, MAMAN. I, 2015, MALAM BOURNA BAGALE. M, 2019, translation is mine). Indeed, the commune of Goudoumaria has several types of oasis-basins, whose contributions to agricultural production and financial are very important for the producers. According to the Environmental Services of Goudoumaria (2023, translation is mine), the township disposes more than 600 oasis-basins. Thus, the effective putting into worth of those basins in the irrigated agricultural production is of a great interest in order to fill the food deficit created by the pluvial cultivations as it was the case of Guirsilik's basin. The main objective of this paper is to apprehend the contribution of the agricultural exploitation of the basin of Guirsilik on the betterment of the food safety and its supply in the intensification of the resilience of the exploited.

Presentation of the Study Zone

The basin of Guirsilik is located at 86 kilometers in South-East of the city of Goudoumaria, the main city of the township. It is a basin with medium water whose tablecloth's deepness is between 2 meters to 3 meters (MALAM BOURNA BAGALE .M, 2019, translation is mine). With 23 hectares of the whole area (10 hectares exploited over the 13 exploitable hectares). It is (basin) exploited during the entire year by 180 exploiters. This basin has benefited the interventions of NGOs Conterpart International, of Projects such as AFRICARE and PLECO. The pluvial agriculture practiced on dune fields and the low ground constitutes the main activity of the population and is greatly destined to the consumption. As far as the irrigated agriculture is concerned, it is practiced in the basin.

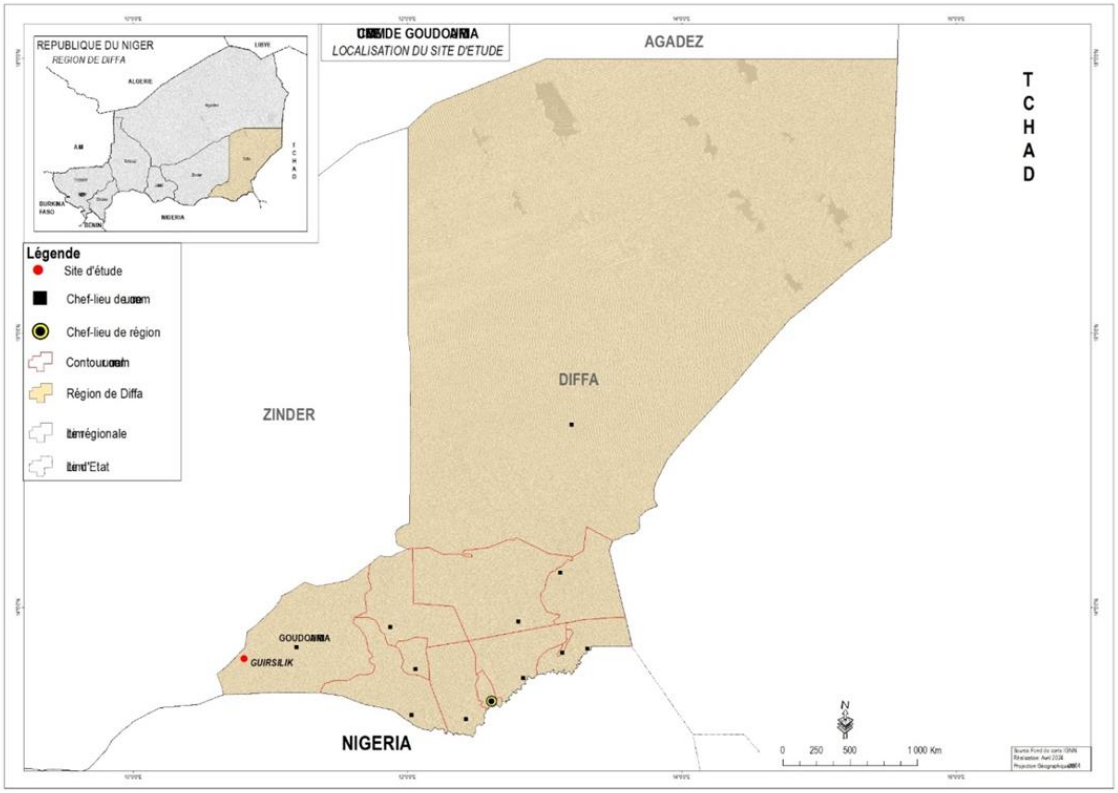


Figure No1: Location map of study site

Materials and Methods

Materials

For the realization of this study, the following appropriate materials and softwares have been used. That was prominently the plug of inquiry and interview guides, a GPS Receiver for taking the coordinates and finally a camera for taking illustrative outlooks. Concerning the software, the Excel spreadsheet has been used for the realization of the graphics as well as the ArcGis softwares for the works of spatialization and Sphinx Plus for the distraint.

The Used Method

The methodological approach used articulates around three main axles. The first one is related to the documentary research that has allowed drawing a list of knowledge on the roles and contributions of oasis-basins cultivations in the way to reduce the vulnerability of the populations of the township.

The second axle has a feature of socio-economic inquiries via a specimen of 161 exploiters of the basin of Guirsilik drawn in an aleatory

manner. The investigations are leant by some remarks in order to identify and analyze the cultivational practices and their impacts on the producers' food safety. To do that, some individual investigations have been conducted through the inquiry plugs and concerned a specimen of exploiters of the basin. This specimen is calculated via the method of exhaustive sampling given by the below equation drawn from GIEZENDANNER. F. D., "the aleatory size of a sample and the error margin" of 2012 (in MALAM ASSANE M, and al, 202).

$$n = \frac{t^2 N}{t^2 + l^2 (N - 1)}$$

n= the size of the sample
N= the number of exploiters (N=180 exploiters)
l= the fork of uncertainty (l= 2e)
e= the error margin (comprises between 0 and 10%, e= 5%)
t= coefficient of margin deduced from the degree of confidence (**1-α**) that we wish (α the level of statistical significance = 5% which gives a degree of confidence of 95% and t associated = 1,96).
The third axle of the methodology is the treatment via the mentioned softwares, the collected data whose results are analyzed and interpreted.

Results

Characteristics of the inquired specimen

The analysis of the specimen shows that the average age of the exploiters is 37, which makes them active cultivators who have 16 years of experiences in the exploitation of the basins. Also, the exploited plots are relatively small with an average of 0.8 hectares per house chief and additionally those exploiters have inherited them from their parents.

Different cultivations of the basin of Guirsilik

The basin of Guirsilik is a basin with agricultural vocation, where many products are produced during many decades (picture No 2) among those products are Maize (picture 1.A), Wheat (picture 1.B), Onion (picture 2.C), Cassava (picture 2.D), Cabbage (picture 3.F), Potato, Lettuce, Gourd and sweet potato. Phoeniculture is also practiced in this basin.

Picture No 1: Cultivation of Maize (A) and Wheat (B) in the basin of Guirsilik

But, with the retreat and the necessity to find other alternatives to fill the cereal deficit, some of these cultivations (precisely Cassava) have tendency to leave place to vegetable cultivations, more economic and with a short period. Moreover, those cultivations allow also to the exploiters to cultivate two times per year, which is not possible with Cassava.

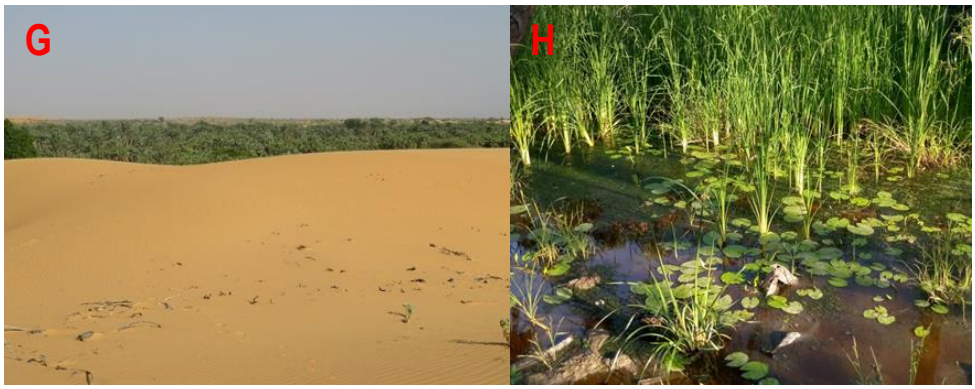
Picture No 2: Cultivation of Onion (C) and Cassava (D) in the basin of Guirsilik

Also, the phoeniculture is practiced in the basin of Guirsilik. The exploitation of date palm carries essentially on the gathering of fruits and this activity is done in two seasons. The first one takes place during the rainy season from June to July and the second one during the dry season from April to March. Indeed, the products of this resource play a vital role as a complement in the feeding of the population as well as its commercialization which brings incomes to the population and the purchase of foods.

Picture N o3: the belt of palm tree (E) and the cultivation of Cabbage (F) in the basin of Guirsislik

Economic rentability and constraints of the exploitation of the basin of Guirsilik

The analysis of the economic rentability bounces out the added values of the producers in food safety of houses and the increase of the incomes. The data collected on the field of the current study show that the rentability is more attractive for the products such as onion, cabbage, lettuce, sweet potato and cassava, de facto of their less elevated intermediary charges. In fact, 10% of the quantities produced in the basin are sold to the local markets; the tubers represent 40% of the flow and the onion 60%. Indeed, the net profit is about 125000 CFA per exploiter in 2024 for an agricultural investment of 25 000 CFA. As for phoeniculture, it contributes to the income of the exploiter on one hand; on the other hand, it comes to him as an alimental complement. However, despite the great contribution of the basin of Guirsilik to the food safety of the exploiters, it faces some constraints for its exploitation. It is mainly the phenomena of silting (picture 4.G) and the lowering of the level of phreatic tablecloth due to the variations of the pluviometry. Also, we have remarked through the last 10 years, sequences of inundations (picture 4.A) which negatively impact the cultivations with a last case in 2022.



Picture No 4: threat of silting (G) and inundations (H) in the basin of Guirsilik.

Usage of agricultural products of the basin of Guirsilik

The cultivational products of the basin of Guirsilik are greatly used in order to satisfy the daily needs of the exploiters (figure No 2).

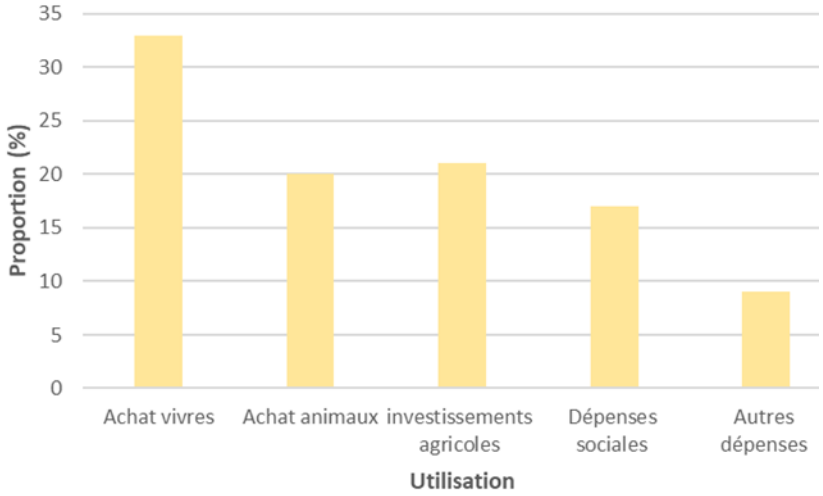


Figure No 2: Utilization of the vegetable cultivations products of the basin of Guirsilik.

The products coming from vegetable cultivations are hugely destined to selling for often buying cereals in order to fill the alimentary deficit caused by the low production of pluvial cultivations. In fact, the agricultural exploitation of the basin allows to each exploiter to have an income of 125000 CFA (per season), 33% are used for buying foods. The buying of animals represents 20% of the income, whereas, 17% are destined to social spendings and 21% are devoted to agricultural investments and the other spendings represent 9%. Thus, the blanket in terms of alimentary needs of the population of Guirsilik is greatly assured by the agricultural productions of pluvial cultivations and vegetable cultivations. Additionally, for 58% of the inquiries, the products resulted from the agricultural exploitation of the basin cover the alimentary needs for about 4 months, against 8 to 10 months for those of pluvial agriculture if the season is satisfying.

Analyzing of the mode of exploitation and production of the basin of Guirsilik

The analysis of the system of exploitation of the basin is established following the mode of functioning of different aureoles of the basin. The first aureole corresponds to dune front, the second to palm grove, the third to spaces of vegetable cultivations and the last one is constituted of naked foreshore where a temporary pool forms itself during the rainy seasons. The figure below shows the percentage of different products of the basin of Guirsilik.

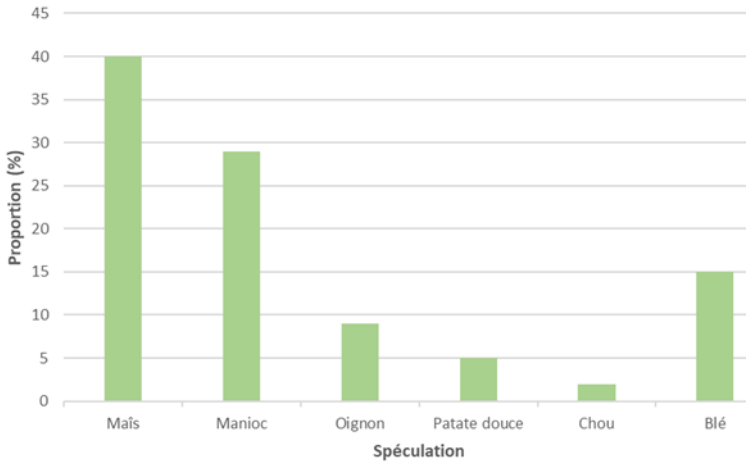


Figure No 3: The proportions of produced (speculations) in the basin of Guirsilik

The agricultural productions of the basin of Guirsilik play a major role in the food safety of the populations. The rentability of the production and the commercialization of the products cultivated varies from one exploiter to another and the importance of the incomes affected in buying foods by the producers (33%) show sufficiently that the agricultural products of this basin contribute to palliate the food deficit of the exploiters and reinforce their resilience. Also, the rural exode is reduced because after the countryside winter the population is busy with the exploitation of the basin. Moreover, the resources such as dates are not directly consumed but engender incomes destined at buying foods. Thus, the average of the produced dates varies between 5 and 25 sacks of100kg according to the producers.

Conclusion And Discussion

The agricultural exploitation of the basin, formerly the second at Guirsilik has become nowadays the pillar of food security, but also the source of income for the exploiters in the context of climate change. These last years, the performances of pluvial cultivations are in decline, which constrains the population to invest more in the intensive putting into value of the basin, where cassava, gourd, sweet potato, lettuce, cabbage, wheat, maize, onion are cultivated as well as the dates with the practice of phoeniculture. In fact, the contribution of vegetable cultivations to the food security has been apprehended at two levels: the direct contribution by consuming the vegetable products and the indirect materialized one by the generated incomes and allow the buying food products especially and other familial spendings. The economic rentability from the selling of the products of the basin of Guirsilik which is averagely of 150 000 CFA per producer, is

superior to the observed one by MAMADOU KAKA A.A (2006, translation is our) nearby some producers who exploit other basins in the township of Goudoumaria which is averagely about 111442 CFA. According to JAHIEL M (1998) in the same township, the part of the whole agricultural income is 51.3% for the cultivations of the basin, versus 15.3% for the pluvial cultivations. Whereas, the number obtained in the current study differs the one found by Amadou M.I in 2011 at the basins of Riria and Alamba in the department of Gouré which are respectively 781 141 CFA and 116 000 CFA. As for the exploited areas, they fluctuate around 0.8 hectares for more than 75% of the exploiters of the basin of Guirsilik. However, on the individual perimeters of Komadougou, the obtained results by MOUMOUNI S.A (1999) show that 65% of exploiters have areas inferior to 1 hectare, 12% comprises between 1 and 1.5 hectares and 23% between 1.5 hectares and 4 hectares. In addition, the production of the dates constitute a contribution to the food security and a source of income for the exploiters of this basin. This study completes the works of JAHIEL M (1998) on the role of date palm in the land and food security. Indeed, the yearly production is of 3 sacks of 100kg averagely per producer and per countryside sold at 7 000CFA the sack. According to KIARI K (2013, translation is mine) in other basins in the township of Goudoumaria where the production of date is averagely 25 sacks of 100kg at a price of 13 120 CFA per sack. This sum is largely superior to that of the current study. Despite the capital role that plays the basin of Guirsilik for the food security, this productive potential faces some diverse constraints that is characterized by the diminution of the quantities of different products. The main threats are silting, the lack of modern amenities, the lowering of the level of the phreatic tablecloth, inundation, lack of enclosure, etc… constitute obstacles to the best putting into worth of this basin.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

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