

Analysis of the Repercussions of Climate Change on the Proliferation of Maize Pest Caterpillars in the Kati Circle

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ABSTRACT

The issue of climate change constitutes a global challenge today. To deal with this, each country must develop its own measures and solutions.

For this research, the objective is to study corn cultivation in the Kati Circle in the context of climate change. To achieve this, the perceptions and adaptation strategies of local populations to the phenomenon of climate change were scrutinized and analyzed.

We surveyed 248 agricultural households in four villages in the Kati Circle. Three hypotheses served as a guiding principle for this research and the methodology used is a combination of quantitative and qualitative approaches.

In terms of results, the consequences of climate change on the local ecosystem are reflected in soil degradation, a reduction in corn production, an increase in the early drying up of ponds and watercourses and the proliferation of certain species. plant and animal (armyworm, aphids and thrips).

To deal with these consequences, while benefiting from support from agricultural technical services, local producers have developed corn growing techniques that are relatively adapted in a context of climate change.

Keywords: Climate Change, Production, Cereals, Corn, Kati Circle

Introduction

Climate change today constitutes a major concern and challenge that all of humanity must face. Global warming is unequivocal [1]. For a Sahelian country like Mali, it represents a big challenge. The backlash from CC affects and threatens important sectors of the country's development. By 2050, population growth and dietary changes will increase food needs by 60 percent. Climate change is already threatening rural systems and livelihoods around the world [2].

Mali's climate is Sahelian and is characterized by great inter-annual variability in rainfall which results in recurrent dry years which have become increasingly frequent since 1968 [3].

Agriculture is the main activity of the populations. Agriculture constitutes the cornerstone of the Malian economy. It employs 80 percent of the population and represents more than 35 percent of GDP [4].

The climate of Kati is Sudanian. The rainfall in the circle varies between 600 and 1000mm. Precipitation is linked to the seasonal swing of the Inter Tropical Front which conditions the division of the year into two very distinct seasons. The rainy season lasts 6 to 7 months (May to October) and a dry season. With these local climatic characteristics, agropastoral and arboricultural production and market gardening are activities developed in the Kati circle. During the year, the temperature generally ranges from 17°C to 39°C and is rarely below 14°C or above 41°C [5].

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Agricultural production in our research area has been marked over recent decades. The quantity of cereals produced is linked on the one hand to recurring variations in precipitation, to the degradation and impoverishment of the soil and on the other hand to the poor farming practices of farmers. Added to this is the low level of supervision of producers and above all the degradation and excessive destruction of natural resources induced by climate change.

The objectives of this study are to know if:

- Is corn production affected by climatic variations in the administrative district of Kati?
- Does the proliferation of caterpillars have a link to climate change?
- And finally, to find out if populations are fighting against CRM?

Materials and Methods

Materials

Documentary Analysis

It concerned the use of documents produced by certain structures operating in the field of the environment and corn cultivation. The documentary analysis allowed us to collect informative data on the Kati circle through the analysis of official and university administrative documents.

Direct Observation in the Field

This approach allowed us to gather non-verbal and verbal data which allowed us to explain phenomena, behaviors and certain facts.

Questionnaire Survey

The questionnaires thus administered were purified. The data collected was entered into Epi Data before being run on SPSS and Excel for analysis.

Excel: is Used

For the development of graphs and tables;
The calculation of certain data which emerges in the different tables;
Calculating averages.

SPSS: is Used

To establish correlations between different variables.
For calculating covariances between variables.

A Camera

A camera for taking photos.

A Smartphone

The smartphone for recording interviews with farmers

Methods

In order to successfully complete our research, we combined several approaches, namely the quantitative approach, the qualitative approach and the mixed approach. These different techniques allowed us to approach populations and understand the environmental and socio-economic context. These different exercises made it easier to compile quite varied data on our theme and to analyze it in quite detailed ways on the basis of the information collected.

We generated the sample of heads of agricultural operating units (UPA) by combining purposive and random sampling methods. We chose to work on the farm as an economic unit of agricultural production. It is made up of a whole number of households, therefore a single household or several households associated for land cultivation or livestock breeding. The head of household or one of them acting as associated household managers. The latter assumes the responsibility of farm manager by making the most important farm management decisions.

In the empirical part, 4 villages were chosen according to the criteria of geographical accessibility and according to the importance of cereal growing and particularly corn growing. The villages thus chosen are: Siby, Ouléssébougou, Safo and Dikan.

In the random part, the list of four (04) villages are retained. And in the empirical part, estimated population numbers (INSTAT, final results of the general population and housing census, 2009) constitute our sampling base for carrying out systematic 2-stage sampling.

Random drawing at the 1st level of concessions per village, according to a sampling interval and from a random starting point. The number of concessions drawn per village is recorded in the table below;

Random draw in the 2nd of a head of Agricultural Exploitation Unit (UPA) per concession selected from the list available at the village head level. The heads of Agricultural Operations Units were subjected to a pre-established questionnaire.

Table 1: distribution of the quantitative sample.

Order	Village	Numbers of leaderships	Numbers of households
01	Siby	31	62
02	Safo	57	62
03	Ouléssébougou	23	62
04	Dikan	22	62

Source: Field survey. September 2023

Monography of the Circle of Kati

The Circle of Kati is a local authority in Mali. It has 37 municipalities and surrounds the Malian capital (Bamako). Kati is located in the South-West part of the Koulikoro Region with an area of 16,895 km². In the North, Kati is limited by the Circles of Kolokani and Koulikoro; to the south are the Circles of Kangaba and Yanfolila; to the East by Doïla and the West of Kati is delimited by the Circle of Kita and the Republic of Guinea-Conakry. According to the General Population and Housing Censuses, the population of the Circle was estimated at 956,753 inhabitants, distributed among the 37 Communes [6]. Its coordinates are: 12° 45' 00" N 8° 04' 00" W / 12.75, -8.066667.

Kati is a cosmopolitan area. Several ethnic groups live there in perfect harmony. In the Circle, we find Bambaras, Malinkés, Soninkés, Dogons, Peulhs, Sénoufos and the Bwa. The economic activities carried out by these populations are essentially dominated by agriculture, fishing, livestock breeding and crafts.

The climate of the area is Sudanian type. The rainfall in the circle varies between 600 and 1000mm. Precipitation is linked to the seasonal swing of the Inter Tropical Front which conditions the division of the year into two very distinct seasons. The rainy season lasts 6 to 7 months (May to October) and a dry season.

Vegetation varies from tree savannah in the Sudanian climate to shrub savannah in the Sahelian zone. Plant species help to fertilize the soil by shedding leaves. From there, organic farming can be developed in the Circle. Currently, there is a degradation of the plant cover due to cyclical droughts, deforestation and bush fires [7].



Results and Discussion

Characteristics of maize pests in the Kati circle

The results of field surveys made it possible to understand that climate change has favored a proliferation of certain animal species in many agricultural production areas. These are desolator caterpillars (*Spodoptera exigua*) which attack a large number of plant species, stem borers, grain pests, armyworms, rodents, termites [8].

These pests have devastating actions on plants. The damage, which can be considerable and rapid, is caused by both adults and larvae [8].

Our research on the question in the survey site provided us with the following table.

Table 2: links between climate change and the proliferation of certain animal species

Responses	Numbers of respondents M/F	Pourcentage
Yes	200	81%
NO	31	12%
NSP	17	7%
Total	248	100%

Source: field survey. September 2023

Analyzing the table on the links between changing climate data and the proliferation of certain animal species, we note that 81% of those questioned find that climate change can promote the proliferation of new animal species. Of the 200 respondents who answered YES, 180 (i.e. 90% of respondents) mentioned the armyworm as the main pest; 15 (7.5% of respondents) mentioned insects and termites, i.e. and 5 people surveyed talked about rodents. Termites and rodents destroy corn mainly in storage areas and granaries. As for insects, their presence can be explained by climatic repercussions. Speaking of these factors we can cite temperature and humidity.

This proliferation of caterpillars and other harmful species has a devastating consequence on plants. These figures are confirmed by the FAO which states that: "...the spread is aggravated by climate change, which creates favorable conditions for the presence of these harmful organisms and the survival of certain plant diseases in new regions [9]. Climate change has already contributed, for example, to expanding the host range and distribution of pests, including the red palm weevil, fall armyworm, fruit fly, desert locust and borer. emerald from the ash tree. » [9].

This result is confirmed by the Revue Duval. Which states that from the end of July in France: "...CRM adults can migrate from fields of grain corn, where the silks are no longer attractive, to fields of late sweet corn with fresher silks. Adult CRMs also feed on corn leaves and pollen, without significant impact on corn yield and quality. They can also feed on sweet corn kernels, which can damage the tips of the ears and provide entry points for pathogens responsible for fungal rots [10].

In the same table, we see that 12% of respondents say that there is no link whatsoever between the issue of climate change and the proliferation of harmful species. And 7% of respondents admit to having no idea about this possible link. But, the respondents almost all admit to having been victims of harmful species. See the 99% above.

As for our study area, among the species found there, we can cite armyworms, aphids, thrips, etc

In the Kati circle, pests cause significant damage to agricultural producers. To effectively combat these pests, farmers combine traditional techniques and modern means. But these techniques can be classified into three categories: mechanical, biological and chemical means of control.



Figure 2: lacunous ear



Figure 3: caterpillar on a corn

Source: field survey. September 2023

In the Kati circle, pests cause significant damage to agricultural producers. To effectively combat these pests, farmers combine traditional techniques and modern means. But these techniques can be classified into three categories: mechanical, biological and chemical means of control.

Populations constantly monitor harmful organisms. When pests appear, populations adopt various methods such as:

- Pest trapping;
- The cultivation of resistant cultivated varieties;
- Cleaning of (Sanitation) of fields;
- Crop rotation;

Speaking of biological methods, people use the substances of certain plants to fight against pests. These natural substances are less expensive and represent an easy-to-use method that leaves little waste.

The State, with the support of its partners, also participates in the popularization of biopesticides. The Malian State, in partnership with the UN agency FAO, released a special fund of 300 million CFA francs (XOF) in 2018, then 626 million XOF in 2019 for the purchase of biopesticides, and the Support Project for agro-

industrial competitiveness in Mali (PACAM) contributed XOF 13 million to the organization of training and information and awareness campaigns [11]. Means of combating pests.

To effectively combat these pests, farmers combine traditional techniques and modern means. But these techniques can be classified into three categories: mechanical, biological and chemical means of control [12-14].

Mechanical wrestling.

Conclusion

This study helped to understand the intimate link between climate change and the proliferation of harmful pests on corn farms. For certain species, the increase in frequency and severity of attacks is due to climatic factors and the quality of facilities serving as granaries. The results of the various carried out in the Kati circle show that 81% of farmers admit that their fields are attacked by pests. And 99% of farmers surveyed use chemical control methods to stem the proliferation of pests. Alongside this method, other less effective methods are used (biological methods, mechanical methods). The chemical method of control has significant repercussions on ecosystems. According to the World Bank, nearly 80% of the pesticides used are expired. And these pesticides degrade the environment. They pollute land and water sources with dramatic consequences for livestock and the food chain.

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