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RESEARCH ARTICLE

CHARACTERIZATION OF THE AGRO-OPERATIONAL SYSTEMS OF SHEA (*VITELLARIA PARADOXA C.F. GAERTN*) FARMS AND HOUSEHOLD DYNAMICS IN THE COMMUNE OF PO, SOUTH-CENTRAL REGION OF BURKINA FASO

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ABSTRACT

Shea production plays a significant role in the economic development of major shea butter-producing regions worldwide. Despite the growing interest in shea, there has been limited research focused on characterizing cropping systems within shea parks and evaluating their contribution to ecosystem functions. This research aims to fill this gap by enhancing the understanding of shea parks and their potential to improve the livelihoods of rural households and the ecosystem services they provide. The study was conducted from January to June 2022 in the commune of Pô, specifically in the villages of Dongo, Katchéli, and Torem, located in the Centre-South region of Burkina Faso. A purposive sampling method, considering producer group and education level, was used to select 116 agricultural producers representative of the study area for interviews. The findings reveal that 68.18% of producers have been utilizing shea parks for several decades. The majority of these producers engage in Assisted Natural Regeneration, and 86.21% apply organic fertilizers to their crops. However, the survey also indicates that 82% of producers do not use improved seed varieties, and 91% rely on plant protection products to safeguard their crops against pest infestations. The results underscore the role of shea parks in providing ecosystem services in the municipality of Pô. Future research should focus on assessing the impact of conservation and restoration efforts on the sustainability and functionality of shea parks.

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INTRODUCTION

Shea products, including kernels and butter, constitute Burkina Faso's fourth largest export commodity, following gold, cotton, and livestock. In 2011, shea butter alone generated 28.991 billion CFA francs, representing 0.60% of the country's gross domestic product (GDP). The overall contribution of all Non-Timber Forest Products (NTFPs) to Burkina Faso's national economy was estimated at 0.63% of GDP in 2008 (MEED, 2012). However, the concept of NTFPs lacks a universally accepted definition. According to the Food and Agriculture Organization (FAO, 2009), NTFPs are biologically derived goods other than wood that originate from forests, other wooded lands, and trees outside forests. Shea products, particularly shea butter, play a critical role in both rural household livelihoods and the economies of numerous countries (Sanou *et al*., 2004; Nouvellet *et al*., 2006; Gwali *et al*., 2012). In Burkina Faso, shea is a vital income source for a predominantly female population across more than 646,000 households. This income enables rural women to achieve financial independence and address essential household needs, including food, clothing, education, and healthcare (Guigma, 2022). Given the significant potential yet advanced degradation of shea species in Burkina Faso's agroforestry parks, particularly in the South-Central region, there is a pressing need for further research to elucidate the contribution of key species within these ecosystems. The present study contributes to this objective by characterizing the operational systems of shea farms in the South-Central region of Burkina Faso.

METHODOLOGY

The work was carried out in a peasant environment between January and June 2022 in three (3) villages (Torem, Katchéli and Dongo) located respectively about 7, 8 and 22 kilometers from the commune of Pô (Figure 1). They belong to the commune of Pô, the capital of the province of Nahouri. The commune is located between the following coordinates: 11°19'03"N and 1°11'29"W to the north, 11°11'49N and 0°57'51"W to the east, 11°00'24"N and 1°06'50"W to the south and 11°10'52"N1°12'42"W to the west.

The climate is of the South Sudanese type marked by two seasons: a wet season that lasts 5 to 6 months from May to October and a dry season that lasts 5 to 6 months from November to April.According to the phytogeographical division of Burkina Faso, the average annual rainfall varies between the isohyets, 900 and 1200 mm of water.The most dominant forest species is *Vitellaria paradoxaC. F. Gaertn* (shea) present in agroforestry parks, but also other species such as *Lannea microcarpa* Engl and K. Krause, *Sclerocarya birrea*, *Piliostigma reticulatum* (D.C.) Hochst, *Parkia biglobosa* Jacq. R. Benth (Néré), *Bombax costatum*, *Ziziphus mauritiana* Lam. *Saba senegalensis*, *Guiera senegalensis* J. F. Gnel, *Acacia macrostacha*, *Acacia nilotica*, *Deutarium microcarpum* Guill, *Tamarindus indica* L. (Thiombiano *et al*., 2012).

In the municipality of Pô, there are 3 types of soil: clay-silt soils, gravel soils and sandy-clay or sandy soils.The producers' perception of shea butter was collected through opinion surveys. For this study, both sexes were involved with 94 women and 22 men. Thus, 116 beneficiaries of TREE AID were surveyed, including 52 in Torem (44.83%), 41 in Dongo (35.34%) and 23 in Katchéli (19.83%).The database used to select the farms was obtained with the actors who work for the protection of shea parks in the area, namely the NGO TREE AID and the Provincial Directorate of the Environment of Nahouri.The selection of producers to be surveyed was made in collaboration with producer groups and shea park developers.

This choice took into account two (02) criteria: (i) involvement in the chains of almond collection, shea butter production and/or processing, and (ii) being available for the survey. A semi-structured questionnaire was administered to selected producers. The questionnaire was previously tested with 5 producers in the village of Dongo before it was administered to the entire sample. The main aspects addressed in this questionnaire focused on the farmer's knowledge of shea production and almond collection chains.

The survey was carried out in two stages: an interview with individual actors and actors organized in cooperative societies and a field visit with the heads of households owning shea parks. For data entry and processing, software was used, namely:

- The KoBoToolBox software was used for the preparation of the questionnaire.
- The ODK app on Android tablet for data collection.
- Microsoft Excel 2013 software, for data entry and processing. The processing of the survey data made it possible to generate tables and figures for interpretation.

RESULTS

Characterization of Shea Farms

Types of Shea Farm Operations : Table I presents the situation of shea farm farms encountered in the study area. In this region, the farms are mostly family-run (73.86%).It can be seen that 13.64% of producers are landowners. 7.95% of producers farm the hut fields and 4.55% of producers have acquired their farms by rental.

Table 1. Types of Shea Farm Operations

Types of operations	Proportion of producers (%)
Family	73,86
Owner	13,64
Box fields	7,95
Rental	4,55

Source: Field survey, 2022

Size of shea farm farms : Table II shows the size of shea farm farms encountered in the study area. It is noticeable that the majority (57.95%) of producers own, on average, a farm of 0-5ha. 31.82% of producers own 5-10ha of farming.Few (10.23%) of producers own large farms with more than 10 hectares.

Table II. Size of shea farm farms

Size of the farm	Proportion of producers (%)
0-5ha	57,95
5-10ha	31,82
≥ 10ha	10,23

Source: Field survey, 2022

Number of years of operation of shea farms: The number of years of operation of shea farms is shown in Table III. Only 10.23% of producers have a number of years of operation ranging from 0 to 10 years.It can be seen that 21.59% of producers exploited their land 10 to 20 years ago. The majority (68.18%) have been operating their fleet for more than 20 years.

Tableau 3. Number of years of operation of shea farms

Nombre d'année d'exploitation	Proportions des producteurs (%)
0-10 years	10,23
10-20 years	21,59
≥ 20 years	68,18

Source: Field survey, 2022

Producers' perception of the security of shea farm operations: The results of this study show that 63.8% of the population find that securing their farms is not necessary (Table IV).

On the other hand, 18.05% find it necessary to secure their farms. Some producers have begun to secure their farms with the documents that are currently being processed. In addition, 1.72% of producers mention land problems and denounce a lack of land service. Surveys show that women do not have the right to own land, they are forced to borrow it.

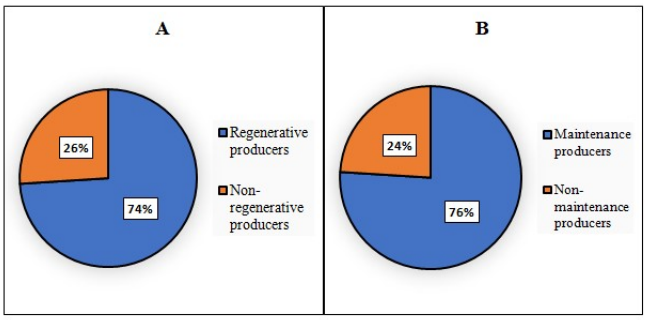
Table IV. Producers' perception of the security of shea farm operations

Opinion	Proportion of producers (%)
Not necessary	78,45
Necessary	18,05
Land issues	1,75
Lack of service	1,75

Source: Field survey, 2022

Cultivation system in shea parks

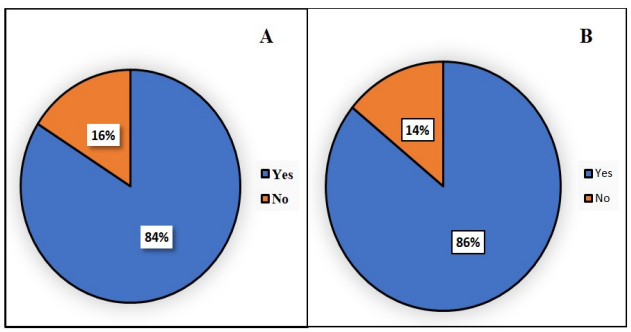
Regeneration and maintenance of shea beds: The results are presented in Figure 1. In general, the majority of producers practice Assisted Natural Regeneration (Figure 9A).As far as maintenance is concerned, the results show that only 24% of producers maintain shea beds (Figure 9B). The shea park does not receive special attention from producers. Maintenance operations (ploughing, hoeing, etc.) applied to associated food crops benefit shea plants. Planting maintenance is limited to pruning the branches when they become too invasive. The majority of producers (79%) say they have shea beds in full production, and that the weight of the almonds collected would be around 16.85 kg/plant. The longest-serving producers in this activity have seen a drop in productivity.



Source: Field survey, 2022

Figure 1. Results of the survey on A) regeneration and B) maintenance of shea beds

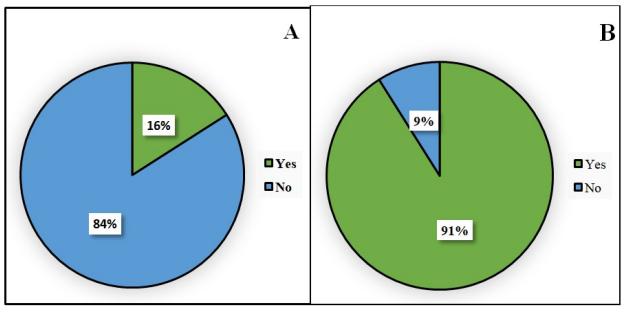
Rate of use of mineral and organic manure by households: Figure 2 shows the rate of chemical fertilizer use by households. It is observed that 83.62% of producers practice agriculture using mineral fertilizer. On the other hand, 16.38% of producers do not use mineral fertilizers.The results of the survey showed that the majority of producers apply organic manure on their farms. Organic fertilisation is applied by 86.21% of producers.On the other hand, 13.79% of producers do not apply it on their farms. The average area that receives organic manure is 1.55ha per household.



Source: Field survey, 2022

Figure 2. Rate of use of mineral and organic manure by households in the locality

Use of improved seeds and plant protection products; Figure 3 shows the status of improved seed utilization. The survey results show that 82% of farmers do not use the improved seed. Only 16% of growers use improved seed on their farms. It is noted that 91% of producers use phytosanitary products to protect their crops in the event of a pest attack.

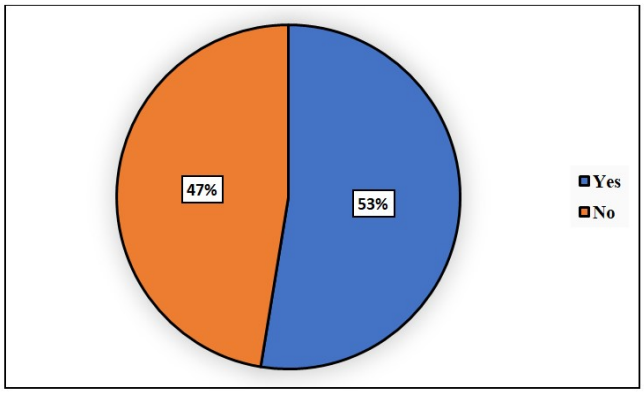


Source: Field survey, 2022

Figure 3. Percentage of use of improved seeds and treatment of shea trees

It can be seen that the majority of growers use herbicides as well as insecticides to protect the crops that have been planted. On the other hand, 9% of producers do not use phytosanitary products on their farms. Indeed, none of the respondents uses phytosanitary products for the maintenance of shea plants.

Access to advisory support and training: Figure 4 shows access to support and advice and training for producers. Support, advice and training were followed by 52.29% of producers compared to 47.41% who never received it.These producers rely on their empirical knowledge for the activities of their farms.



Source: Field survey, 2022

Figure 4. Access to advisory support and training

DISCUSSION

Characterization of Shea Farms : In the study area, the farms are mostly family-owned. The majority of producers have an average farm of 0-5ha. The method of acquiring the plots of land is essentially by inheritance.Access to land remains limited and reduces the possibility of increasing the area and thus the total production. The majority of producers operate their farms for a long time (20 years or more).Generally speaking, producers find that securing their farms is not necessary.

I propose the following text: Within the study area, shea farms are predominantly family-owned enterprises. The majority of producers manage farms with an average size ranging from 0 to 5 hectares. Land acquisition is primarily achieved through inheritance, which constrains access to additional land and subsequently limits the potential for expanding farm area and total production capacity. Most producers have been cultivating their farms for extended periods, typically 20 years or more. Generally, producers perceive that formal land tenure security measures are not essential for the continuation of their agricultural activities.

Cultivation system in shea parks: The majority of producers engage in Assisted Natural Regeneration (ANR), a practice likely influenced by the training they have received on sustainable natural resource management. Additionally, the producers' commitment to ANR is largely driven by awareness initiatives promoted by stakeholders in the shea sector. These initiatives emphasize the dual benefits of enhancing income and mitigating land degradation, which resonate strongly with producers seeking additional revenue sources. These findings align with those of Boffa (2000), who observed that young woody trees are often marked with painted stakes to enhance their visibility and protect them from grazing, tillage, and fire. Furthermore, the work of Kaboré *et al*. (2012) indicates that the spatial distribution of naturally established shea seedlings is often suboptimal for future tree development, as most juveniles are located under the canopy of mature seed-bearing trees. Ouoba *et al*. (2020) further emphasize that human intervention is essential to guide the spatial distribution of these young plants to ensure successful establishment and growth into mature trees.

Maintenance operations, such as ploughing and hoeing, conducted on associated food crops have a beneficial impact on shea plants. The maintenance of shea plants is generally confined to pruning branches when they become overly invasive. The primary motivation for producers lies in the low investment and minimal labor required by shea parks, coupled with the potential for financial returns. Producers utilize shea parks to optimize the use of available space and increase the profitability of their farms. These findings are consistent with those of Boffa (2000), who noted that this practice is commonly employed in agroforestry systems where trees are integrated with both food and cash crops. Similarly, the work of Gnanglè *et al*. (2012) demonstrated that within this system, farmers cultivate agricultural crops in conjunction with deliberately selected and preserved trees, which provide multiple benefits, including wood, non-timber forest products, and soil fertility enhancement.

The longest-serving producers in this activity have seen a drop in productivity. This decline in productivity is linked to poor soils, lower rainfall and climate change.Our results are in agreement with those of Guira and Zongo, (2002) who showed that the average production per tree obtained ranged from 15.38 kg of fruit to 13.76 kg of fruit. Guira and Zongo (2002) attributed this variability in production to the genetic nature of the trees (Guira and Zongo, 2002).The results of the work of Lamien *et al*., (2004) showed that this would be linked to insufficient pollination, limitation of nutrient resources, predation of reproductive organs as well as limiting climatic conditions. Producers practice agriculture using mineral fertilizers. On the other hand, a minority of producers do not use mineral fertilizers. Organic manure applied by producers could be explained by its availability in households.The work of Bazemo (2016) has shown that the use of organic and mineral fertilisers to improve the entire fertilisation chain is a global need expressed by all categories of producers.The majority of producers do not use the improved seed. This situation is linked to illiteracy.

The work of Nana (2017) has shown that the level of education conditions the mastery and application of the texts of agricultural groups and the openness to innovation and agricultural production techniques. The majority of growers use herbicides as well as insecticides to protect crops. This could increase the risk of environmental contamination and health risks. Many producers rely on their empirical knowledge to carry out the activities of their farms.

CONCLUSION

This study contributes to advancing the understanding of shea parks and their potential to enhance ecosystem services in the Centre-South region of Burkina Faso. The findings indicate a decline in shea productivity, primarily due to the aging of trees and the detrimental effects of climate change on park yields. Furthermore, the knowledge and implementation of effective care and regeneration practices for shea plants among farmers are limited. Based on these outcomes, we recommend expanding areas dedicated to assisted natural regeneration to promote the growth of young plants that will eventually replace the aging tree population. Future research should focus on evaluating the impact of conservation and restoration efforts on the sustainability and productivity of shea parks.

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