



RESEARCH ARTICLE

THE USE OF MOSQUITO NETS IN BANANA'S FARM PROTECTION IN LOKOSSA DISTRICT IN SOUTH-WESTERN REPUBLIC OF BENIN, WEST AFRICA

*Lègba Nazaire Aïzoun

Laboratory of Pluridisciplinary Researches of Technical Teaching (LaRPET), Normal High School of Technical Teaching (ENSET) of Lokossa, National University of Sciences, Technologies, Engineering and Mathematics (UNSTIM) of Abomey, P.O. Box 133 Lokossa Cel: +229 0195317939 / +229 0169465070 Cotonou, Benin

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*Corresponding author:

Lègba Nazaire Aïzoun

ABSTRACT

Crop's protection is necessary at increasing crop yields. The current study was aimed to investigate on the use of mosquito nets in banana's farm protection in Lokossa district in south-western Republic of Benin, West Africa. The locations of Agnivèdji and Sahouèkomey were surveyed in November 2024 during the small rainy season to collect information about the number of banana's farms protected by mosquito nets, the kind of mosquito nets used, the disposition of mosquito nets in banana's farm protection, the number of mosquito nets used in banana's farm protection and the aspect of mosquito nets used. The results showed that thirty six (36) cultivations were protected by mosquito nets in Lokossa district. The number of banana's farms protected by mosquito nets in Sahouèkomey was higher than that of Agnivèdji location. Two kinds of mosquito nets were used in banana's farm protection. There were: Permanet 2.0 and Olyset net. The number of Permanet 2.0 used in banana's farm protection was higher than the number of Olyset net used for this purpose. The use of mosquito nets in cultivation protection in Mono department is a reality in Benin country. This phenomenon is a bad practice as these mosquito nets must serve to control malaria vector.

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INTRODUCTION

In sub-Saharan African countries, rapid urbanization has resulted in a growing demand for staple foods. This ever-increasing demand for food exceeds the level of supply. Almost 33% of the population of sub-Saharan Africa, or nearly 200 million people, were short of food in 2005 (FAO, 2006). In a decade, this population of hungry people has increased to 256.5 million in 2017 (FAO, 2018). Since the 2000s, fruits and vegetables have become increasingly important in the development of the agricultural sector in many African countries due to their economic returns, nutritional value, and latent capacity to be exported to the international market. Vegetable crops are important sources of protein, vitamins, trace elements and antioxidants and are known to have health benefits (Chu *et al*, 2002; Singh *et al*, 2007). Low fruit and vegetable consumption is the cause of 31% of ischemic heart disease and 11% of strokes worldwide (OMS, 2002). Alternative methods of pest and disease control such as the use of natural plant extracts as biopesticides (Isman, 2015; Stevenson *et al*, 2017) have not proven to be sufficient to control pests. It is therefore becoming important to promote other more environmentally friendly methods of insect control such as physical control. The use of insect netting can help reduce pest and disease problems (Guo *et al*, 2015).

Unfortunately, this technology is unavailable to small-scale farmers in Africa. The netting technology is a pest control method that is safe for gardening and is progressively being adopted as a viable option for small-scale farmers. It promotes acts like keeping the garden clean and weeded, use of mulches to promote water retention in the soil, and the use of organically made pesticides when absolutely necessary. This is to protect the crops from harmful vectors as opposed to chemical use. As the determination towards organic farming grows, more local farmers are warming up to the idea of using the farm nets also known as Eco-friendly nets.

Assogba-Komlan *et al* (2021) had recently assessed the effects of the use of insect nets in vegetable production in four departments of southern Benin (Mono, Couffo, Ouémé and Plateau) using an interview guide and a structured questionnaire. Very few researches were published on the use of mosquito nets in banana's farm protection in Lokossa district in south-western Republic of Benin, West Africa. Therefore, there is a need to carry out new researches for this purpose. The goal of this study was to investigate how people used mosquito nets to protect their banana's farm in Lokossa district in south-western Republic of Benin.

MATERIAL AND METHODS

Study area: The study area is located in Republic of Benin (West Africa) and includes the department of Mono. Mono department is located in the south-western Republic of Benin and the study was carried out in Lokossa district more precisely in the locations of Agnivèdji and Sahouèkomey (Figure 1). The southern borders of this district are Athiéme and Houéyogbé districts. The northern border is Dogbo district. The eastern border is Bopa district and the western border is Togo republic. Lokossa district covered 260 km². The choice of the study sites took into account the economic activities of populations, their usual protection practices against mosquito bites and peasant practices to control farming pests. Lokossa has a climate with four seasons, two rainy seasons (March-July and August-November) and two dry seasons (November-March and July-August). The temperature ranged from 25 to 32°C with the annual mean rainfall, which is between 900 and 1100 mm.



Figure 1. Map of Republic of Benin showing Lokossa District surveyed

Data collection: The study was carried out in November 2024 during the small rainy season in the locations of Agnivèdji and Sahouèkomey in Lokossa district. These locations were surveyed to collect information about the number of cultivation protected by mosquito nets, the kind of mosquito nets used, the aspect of mosquito nets used, the disposition of mosquito nets in cultivation protection and the number of mosquito nets used in banana's farm protection.

Recording of the number of cultivation protected by mosquito nets: The farms of the locations of Agnivèdji and Sahouèkomey in Lokossa district were surveyed by a team of the Laboratory of Pluridisciplinary Researches of Technical Teaching (LaPET) and the number of cultivation protected by mosquito nets was counted and noted in some registering forms in November 2024.

Recording of the kind of mosquito nets used: In similar way, the kind of mosquito nets used in banana's farm protection was counted and noted in some registering forms in November

2024. For that, the farms of the locations of Agnivèdji and Sahouèkomey in Lokossa district were surveyed by a team of the Laboratory of Pluridisciplinary Researches of Technical Teaching (LaPET).

Recording of the aspect of mosquito nets used: The aspect of mosquito nets used in banana's farm protection was counted and noted in some registering forms in November 2024. For that, the farms of the locations of Agnivèdji and Sahouèkomey in Lokossa district were surveyed by a team of the Laboratory of Pluridisciplinary Researches of Technical Teaching (LaPET).

Recording of the disposition of mosquito nets in cultivation protection: In similar way, the disposition of mosquito nets in cultivation protection was counted and noted in some registering forms in November 2024. For that, the farms of the locations of Agnivèdji and Sahouèkomey in Lokossa district were surveyed by a team of the Laboratory of Pluridisciplinary Researches of Technical Teaching (LaPET).

Recording of the number of mosquito nets used in banana's farm protection: The number of mosquito nets used in banana's farm protection was counted and noted in some registering forms in November 2024. For that, the farms of the locations of Agnivèdji and Sahouèkomey in Lokossa district were surveyed by a team of the Laboratory of Pluridisciplinary Researches of Technical Teaching (LaPET). In addition, the team of LaPET had taken photos in the field during our surveys of some mosquito nets used in banana's farm protection.

STATISTICAL ANALYSIS

A chi-square test for proportion comparison was performed on the data sets gathered from both locations surveyed to compare the number of mosquito nets used in banana's farm protection. The significance level was set at 5%.

RESULTS

Number of cultivation protected by mosquito nets: The analysis of Table 1 showed that thirty six (36) banana's farms were protected by mosquito nets in Agnivèdji and Sahouèkomey locations in Lokossa district. Twelve (12) banana's farms were protected by mosquito nets in Agnivèdji location whereas twenty four (24) banana's farms were protected by mosquito nets in Sahouèkomey location.

Disposition of mosquito nets in cultivation protection: The analysis of Table 1 showed that regarding the disposition of mosquito nets around of the farms, there were many: Mosquito nets caught with dry woods and with branches of palm-tree, or mosquito nets caught with trees, with branches and with dry leaves of palm-tree, or mosquito nets caught with a palisade made of dry branches of palm-tree, dry woods and trees or mosquito nets caught with dry woods on fences.

Kind of mosquito nets used: The analysis of Table 1 showed that two kinds of mosquito nets were used in banana's farm protection. There were: Permanet 2.0 and Olyset net. The number of Permanet 2.0 used in banana's farm protection was higher than the number of Olyset net used for this purpose.

Table 1. Recording of the number of cultivation protected by mosquito nets, the disposition of mosquito nets in cultivation protection and the kind of mosquito nets used in banana's farm protection

Locations	Number of banana's farm protected by mosquito nets	Disposition of mosquito nets in banana's farms protection	Kind of mosquito nets used in banana's farm protection
Agnivèdji	12	Mosquito nets caught with dry woods and with branches of palm-tree	Permanet 2.0
		Mosquito nets caught with trees, with branches and with dry leaves of palm-tree	Olyset net
Sahouèkomey	24	Mosquito nets caught with a palisade made of dry branches of palm-tree, dry woods and trees	Permanet 2.0
		Mosquito nets caught with dry woods on fences	Olyset net

Table 2. Recording of the number of mosquito nets used in banana's farm protection and the aspect of mosquito nets met in farms surveyed

Locations	Number of mosquito nets used in banana's farm protection	Aspect of mosquito nets used in banana's farm protection	
Agnivèdji	Permanets : 18 Olysetnets : 09	17 Intact 09 Intact	01 Torn 00 Torn
Sahouèkomey	Permanets : 45 Olysetnets : 17	43 Intact 16 Intact	02 Torn 01 Torn

Number of mosquito nets used in banana's farm protection: The analysis of table 2 showed that the number of mosquito nets used in banana's farm protection in Sahouèkomey location was higher than that used in Agnivèdji location. The Permanets were the most used in both locations. In addition, the number of Permanets used in Sahouèkomey was higher than that used in Agnivèdji ($p < 0.05$). This remark was similar with Olyset nets.

Aspect of mosquito nets used: The analysis of table 2 showed that regarding the aspect of the mosquito nets met in the banana's farms, almost of them were intact. Very few were torn with small holes. Holes in the mosquito nets were often observed when they were using in palisade building.

The following figures came from photos taken in the field during our surveys:

DISCUSSION

In the current study, in the locations of Agnivèdji and Sahouèkomey in Lokossa district, the banana's farms were often attacked by pests mainly herbivore animals (beef, sheep...), as these different farms are not far from the human houses. Farmers used different mosquito nets to protect their cultivations such as: Permanet 2.0 and Olyset net. These mosquito nets were often received from the different free distribution of Long-Lasting Insecticidal Nets (LLINs) by the National Malaria Control Program (NMCP). Some of these mosquito nets used in cultivation protection may be bought by farmers or received as donation by them. Permanet 2.0 and Olyset are impregnated with pyrethroids. According to Zaim *et al* (2000), pyrethroids have unique modes of action such as fast knockdown and excito-repellent effects. Instead of using the mosquito nets which are regularly distributed free by the NMCP and which are Long-Lasting Insecticidal Nets (LLINs) against mosquito bites, peasants prefer using them to protect their cultivation. Across the world, netting has evolved into a crucial equipment for agricultural activities. Its function is to physically separate crops, livestock, and other items that can interfere with their growth or negatively impact them. The many advantages of employing netting in agriculture from higher crop yields to enhanced animal welfare will be covered in this essay.

Additionally, it will look at how this technology might be applied to a larger drive for sustainability and food security. Finally, it will explain how netting, by shielding us from unwelcome pests and disease-carrying animals while still allowing us access to essential resources, favourably influences our irrational yearning for freedom. This essay intends to show why netting should be taken into account by everyone involved in farming and associated businesses by studying these aspects (Howard, 2023). In agriculture, netting is a multipurpose instrument that shields crops from pests, birds, and other elements. Natural or synthetic materials, such as nylon, cotton, burlap, jute, or bamboo, can be used to make it. The kind of material used depends on the size of the crop that needs to be protected and how much protection is required. In addition to providing a physical barrier between plants and animals that may otherwise harm them, netting also allows air, sunlight, and moisture to access the crop, preserving the possibility of healthy yields (Howard, 2023). Regarding the aspect of the mosquito nets met in the farms, almost of them were intact. Very few were torn with small holes. Holes in the mosquito nets were often observed when they were using in palisade building. The way the farmers put mosquito nets is a barrier against herbivore animals. This way, cannot protect cultivations from the attack of insect pests. In fact, farmers used different ways such as: Mosquito nets caught with dry woods and with branches of palm-tree, or mosquito nets caught with trees, with branches and with dry leaves of palm-tree, or mosquito nets caught with a palisade made of dry branches of palm-tree, dry woods and trees or mosquito nets caught with dry woods on fences. For that reason, mosquito nets must be put in order to cover the leaves of the cultivations in the different farms even if that needs a lot of mosquito nets when the farm is big. Some particular nets without insecticide must be promoted to the farms. These nets are different from mosquito nets distributed free by NMCP and are called nets against pests. The nets against pests respect environment and peasant health by contrast to the use of impregnated mosquito nets or use of pesticides against pests. A study carried out by Assogba-Komlan *et al* (2021) in southern Benin showed that it is necessary to sensitize farmers to the use of nets to protect plants. This will significantly reduce pest attacks and reduce the use of pesticides in production. In addition, Howard (2023) had studied the agricultural netting benefits, the available netting types and the setting up and maintaining nets.



Figure 2. Permanets in the protection of banana's farm in the location of Agnivèdji



Figure 3. Olyset nets in the protection of banana's farm in the location of Sahouèkomey

According to this author, using netting effectively in agriculture mostly depends on how well it is installed. For instance, even though the fabric was intended to avoid this kind of damage in the first place, if there are gaps or holes in it, pests could still get through and injure the crop. When installing the nets, appropriate tensioning methods and staking procedures must be used to ensure that they create an effective barrier against potential threats while always allowing enough airflow during their lifespan of use. Regarding the setting up and maintaining nets, according to Howard (2023), in addition to offering shade and wind protection, nets are an efficient and effective method of protecting crops from pests. Although installing and maintaining netting is not a difficult task, it does require some understanding to make sure the netting fulfils its function. The installation and upkeep of nets for agricultural use will be covered in this article. When installing a net, the first step is to measure the area that needs to be covered and, if necessary, add extra length to each side before cutting it to size. Then, using posts or poles positioned at a distance that allows for easy access between them, it should be suspended above the crop. To prevent any wild animals from crawling under the net, the edges can be secured with weights or pegs along the bottom edge. Fitting nets over tall plants or trees also

requires extra care because they need support points that are higher up than usual. Once the nets are in place, they should be periodically inspected to see if there are any breaches that might allow animals to enter the protected zones. Weather-related or wildlife-related damage should be addressed right away by either swapping out damaged pieces of the cloth or sewing new sections together. Furthermore, nets must be taken down every few months to allow for natural sunlight and airflow, which promotes optimum growth levels in crops and prevents the establishment of mould because of humidity buildup underneath coverings. Regarding the available netting types, the insect screening is the first kind of netting frequently used in agricultural operations. Bird netting is another typical type of netting used in agriculture. Last but not least, shade mesh provides both thermal and physical protection from high temperatures and direct sunshine. These nets were different from mosquito nets which were recommended in malaria vector control.

CONCLUSION

The physical barrier of the untreated mosquito nets is still useful against mosquito bites when these mosquito nets are intact or without hole. Other methods to control farming pests must be vulgarized to the farmers in order to change their behaviors or practices in protected cultivations. There are many different kinds of netting that can be used in agricultural operations today, and each one offers different advantages depending on the specific requirements posed by local weather patterns, pest infestations, and other factors influencing overall crop production efforts along the way.

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