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Environmental Impacts of the irrational Use of Pesticides in the Villages Bordering the UNESCO World Heritage Site, Monts Nimba Biosphere Reserve-Republic of Guinea

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Abstract

The general objective of this work is to inventory and characterize the risks of non-rational use of pesticides on human health and the environment in order to propose prevention and mitigation measures. Thus, the Accelerated Participatory Research Method (MARP) was used to collect data from resource persons, through semi-structured interviews based on survey sheets. Word and Sphinx Plus V5 software allowed us to process the data collected. Approximately 42 phytosanitary products including 21 herbi-total (95.5%), 11 herbi-selective (61.4%) and 9 insecticides were encountered in the localities surrounding the site. Agriculture (40.8%) is the most practiced activity followed by livestock breeding (19.4%), hunting and gardening (9.7%), fishing (7.8%), carbonization (6.8%). The lowlands remain the cultivation area par excellence (42.9%) followed by the hills (38.1%) and the plains (19.0%). The Lola and N'Zoo markets (32.1%) supply products followed by the Bossou and Gbakoré markets (10.3%), as well as fungicides and fertilizers, subject to order. The March-April period (39.2%) is the period of heavy use while June-August (29.7%) and May-June (24.3%) are the periods of weeding with selective Herbi; on the other hand, September-December (6.8%) is the period devoted to market gardening activities. The effects on the ecosystem are noted, but there are no mitigation measures; the biotope and the biocenosis are frequently polluted and the animals are contaminated and removed from their natural habitats.

Keywords: Environmental impacts; irrational use; pesticides; heritage site.

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I- Introduction

Before the advent of phytosanitary products, cultivation systems were designed to ensure the best compromise between phytosanitary risks and the production potential of the crop [1,2]. It was in the 1940s that synthetic pesticides appeared on the market, with very positive results in increasing agricultural yields. Twenty years later, the first accusations of harm to people's health and the environment were heard. Pesticides, products of destruction of harmful organisms, can be held responsible for loss of biodiversity and deterioration of natural habitats [3-5]. These effects are mainly related to the use of pesticides in agriculture.

It therefore appears imperative to present a summary assessment of the state of knowledge on these effects [6]. The same author [6] indicates that it is important to remember that the evaluation of the health effects of pesticides turns out to be a complex exercise which lends itself to ambiguity for several reasons including the intrinsic toxicity of different phytosanitary products which varies considerably depending on the products. .

Losses in the conservation of agricultural products are common in tropical zones and can reach 25% for stored grains and seeds and 40% or even 50% for vegetables. These losses are due to internal factors of agricultural products (respiration, maturation, desiccation), but also external factors (mechanical damage, pathogens, insects, rodents and other animals) [7, 8]. It is estimated that 2.5 million tonnes of pesticides are applied to crops worldwide each year [9].

Pesticides constitute an important issue for the quality of our food and our environment. Health being the main concern of consumers and the environment, laws and standards must also follow new ideologies, which will serve the well-being of our planet and our health [10,11].

Pesticide residues are found in soil, water and on crops. They enter the food chain and are finally ingested by humans through food and water. Plant protection products are carcinogenic (15 to 20%) and most of them are endocrine disruptors, meaning they can cause congenital malformations in children and sterility in humans [12].

As can be seen from the numerous studies carried out, pollution linked to agricultural activities has continued to grow and has become one of the main sources of pollutants that affect the health of waterways and humans. The cause of the deterioration in the quality of surface water and groundwater is the irrational use of fertilizers and pesticides [13].

These health and environmental risks are increased by the fact that around 30% of pesticides marketed in developing countries (for an estimated value of US$900 million per year) do not meet international quality standards [14,17].

The analysis of producers' access to agricultural innovations falls within the overall framework of a series of reflections that scientists must engage with those involved in agricultural production [18].

Currently, 33% of the population in West Africa resides in urban centers, compared to only 19.6% in 1975 [19]. Since 2011, the Guinean government has supported the importation and subsidized distribution of phytosanitary

products and fertilizers without sufficiently taking into account the risks to human health and the environment in its provisions and development strategies for the agricultural sector [20,23]. However, this sector, apart from climatic constraints, other limiting factors such as plague attacks on different scales which cause the use of chemical pesticides [24, 25].

In order to increase the yield of agricultural production, farmers or agricultural producers have adopted the use of pesticides or herbicides in an inappropriate manner due to lack of knowledge of these pesticides.

Thus, the majority of the population of the villages bordering the Nimba Mountains Biosphere Reserve is active in the agricultural sector and mainly agriculture which constitutes an important contributor to family income. However, the use of these pesticides increases the number of chronic diseases such as cancer, congenital malformations, mental deficiencies, neurological and reproductive disorders, endocrine disruptions, weakening of the immune system, to name but a few [26].

Thus, in order to make local populations aware of the harmful effects of pesticides in agriculture around heritage, we have chosen the theme "Environmental impacts of the irrational use of pesticides in the villages bordering the world heritage site of NESCO, Monts Nimba Biosphere Reserve".

1.1-General objective

The general objective of this study is to inventory and characterize the risks of non-rational use of pesticides on human health and the environment in order to propose prevention and mitigation measures.

1.2-Specific objectives

- ✓ Inventory the different types of pesticides used in localities bordering the UNESCO World Heritage site;
- ✓ Characterize all potential risks to human and environmental health;
- ✓ Raise user awareness of the harm caused by the irrational use of pesticides on health and environmental protection.

II- Materials and Methods

2.1- Materials

Presentation of the Study Area

The Nimba Mountains Biosphere Reserve (RBMN) is heir to the Nimba Mountains Strict Nature Reserve (RNIMN) created in 1944. It is the result of numerous scientific research works and successful approaches by eminent researchers such as Roger Heims, M. Lamotte, R. Schnel, J.C. Leclerck, R. Roy etc. from 1939 to 1944. This integral nature reserve became a Biosphere Reserve in 1980 and its first central area became a UNESCO World Heritage Site in 1981, following the progressive degradation observed in this reserve, the first part of the area central (world heritage site)) was included on the list of heritage in danger in 1992 by the UNESCO World Heritage Committee. The Monts Nimba Biosphere Reserve covers an area of 145,200ha and corresponds to the Guinean part of the Cavally river basin. It includes three (3) categories of protected areas including:

- A cluster of three (3) central areas of 21,780 ha strictly protected including:

• The Guinean part of the Nimba Mountains range which constitutes the UNESCO world heritage site of 12,540 ha is our main area of investigation;

• The Bossou chimpanzee hills of 320 ha and,

• The Déré forest of 8920 ha.

- A buffer zone of 35,140 ha where activities are strictly controlled and,
- A transition area of 88,280 ha where activities are monitored [27] (P. MOLOUMOU et al, 2011)

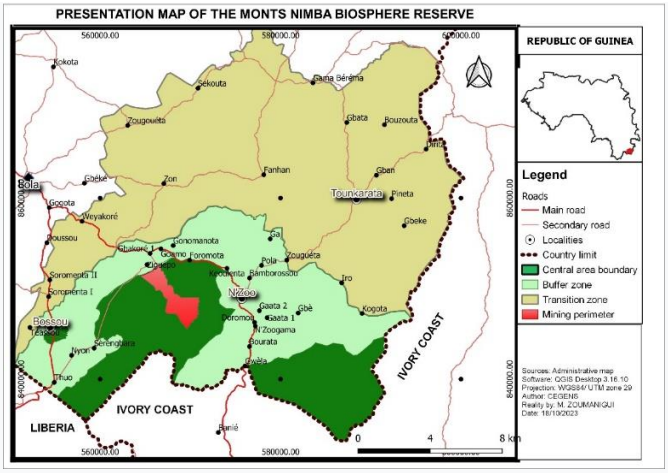

Figure1*:* Map of the Nimba Mountains Biosphere Reserve (RBMN)

2-2- Methods

To achieve our objectives, the research team carried out bibliographic consultations and used the Active or (Accelerated) Participatory Research Method (MARP) through semi-structured interviews based on the survey sheets.

Treatment methods

Using Word software, Sphinx Plus V5., we processed the various data collected in the field, the results of which are mentioned below.

III- Results and Interpretation

Following the processing of the data collected, we present to you the results we have achieved.

3.1- List of some phytosanitary products encountered or used in the villages bordering the UNESCO World Heritage site.

Table 1 presents the herbicides encountered and used in the villages bordering the UNESCO World Heritage site.

Table 1: List of some phytosanitary products

N°	**Total Herbicide**	**Sélective Herbicide**	**Insecticides**
1	Etoile+Guinée 480L +	Malokononi 720SL +	Soro lambdaGuinée 25EC +
2	Mawoulamba 480SL +	Malogbê 200WP +	Good lambda 250EC +
3	Namakoro 276 +	ESF/Herxtra 720SL	Top lambda 25EC +
4	Power 888WG	Ibextra 720SL	Grosudine super 50
5	Glyphalm 500WG	Akafissa 108EC +	Cacao super 40EC +
6	Konkonba n°1 SS +	Matrix+ 108EC	Vagakènè lambda super +
7	Lamachette 360SL +	Extra plus 720SL +	Soro Lamda 2 ,5EC
8	Sénésamôkô 480SL +	Calliherbe 720SL	Insecticide Delmix
9	Rapid Max 750WG	Topextra 720SL	Lamda Super 2 ,5EC
10	Tasman 757SG	Tiadjiguimafa	
11	Killer 780WG	Mais_Star	
12	Baleyage 780SG +		
13	Malolasabati 720SG +		
14	Glycot 757SG		
15	Fasodemena 780WG +		
16	Adjuman 780SG		
17	Béré-red +		
18	Herbti-total +		
19	Glyphodaf 360SL		
20	Yacousate N^{O}1 480SN		
21	Original Herbitotal		

Legend: + *(product used by farmers)*

A significant number of phytosanitary products are sold *(21 herbi-totals, 11 selective herbicides and 9 insecticides)*, several of which are used by farmers in the villages bordering the UNESCO heritage site.

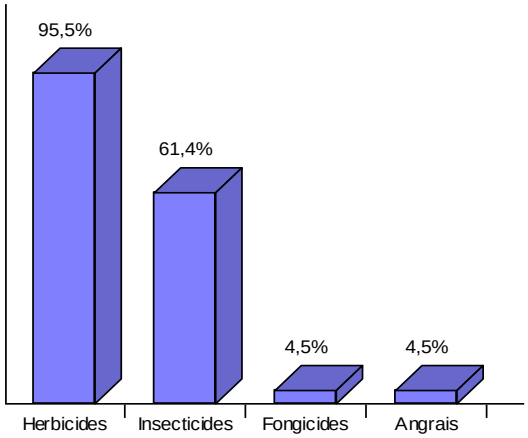

Figure1: Percentage of use of phytosanitary products in the locality

It follows from this figure that total herbicides are the most numerous on the market and the most used (95.5%) for land cleaning, followed by selective herbicides (61.4%) used to reduce weeding expenses and save working time. As for insecticides, they are used against harmful insects in crop areas (plantations), while the use of fertilizers is very limited due to its scarcity on the weekly riverside markets.

3.2- Activities practiced in the villages bordering the UNESCO heritage site

According to field surveys, different activities are carried out in the locality to diversify sources of income and improve living conditions. All these activities are practiced at different levels as the following graph shows:

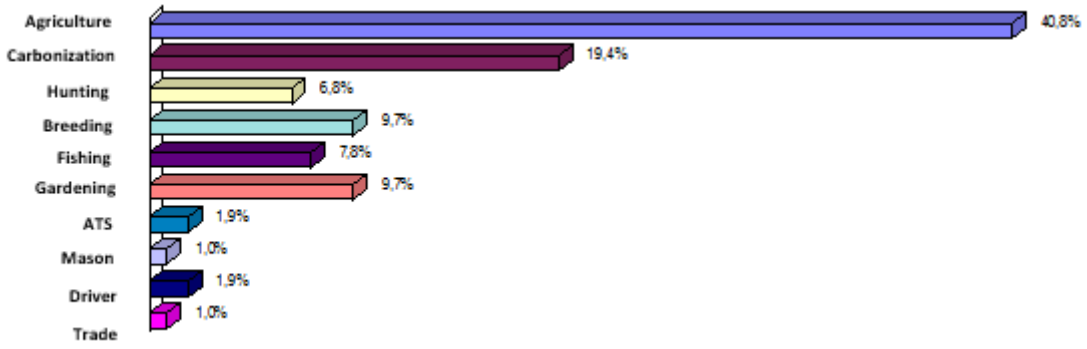

Figure 2: Activities carried out in the riverside villages

It appears from this figure that agriculture (40.8%) is the most practiced activity in the locality for a local population with an essentially agricultural vocation who use pesticides to facilitate their activities, which confirms the assertion [2] which states that urban and peri-urban agriculture is already used by around 700 million city dwellers (around one in four people in the world), followed by livestock breeding (19.4%), hunting and gardening (9 .7%), fishing (7.8%), carbonization (6.8%). This undoubtedly allows us to affirm that the local populations are attached to the land and natural resources to satisfy various needs.

3.3- Comparison of crops based on pesticide use

To understand the degree of pesticide use per crop, we collected data from local populations whose configuration is as follows:

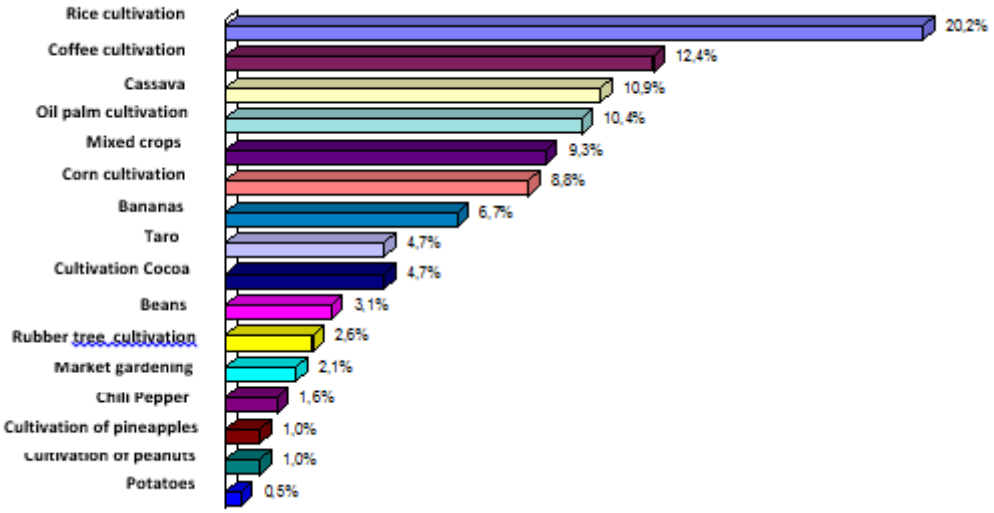

Figure3: Crops where pesticides are used

The analysis of this figure lets us see that all the crops used by the local population for their needs receive treatments with phytosanitary products even if the degrees are not the same. Rice cultivation occupies first place (20.2%) because it is practiced in all areas of cultivation (hill, plain and lowlands), while sweet potato cultivation comes in last position. to the fact that it is not a special culture but an accessory culture or mixed with other cultures.

The three (3) growing zones are unequally occupied as shown in the graph.

A crop mixture sprayed with herbi-total on one side and herbi-selective on the other side in Séringbara

A lowland pulverized in Kéoulenta

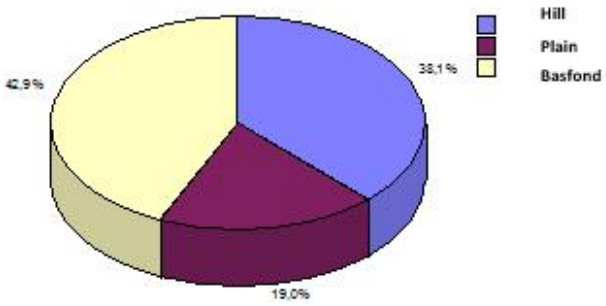

Figure4: Pesticide use zones

The lowlands remain the cultivation area par excellence (42.9%) where pesticides are used more, followed by the hills (38.1%) which receive food crops or substances while the plains (19.0%)) are occupied by perennial plantations.

3.4- Sources of supply

The use of phytosanitary products does not refer to any regulation or law, thus leading users to obtain their supplies from different markets and with the means at their disposal.

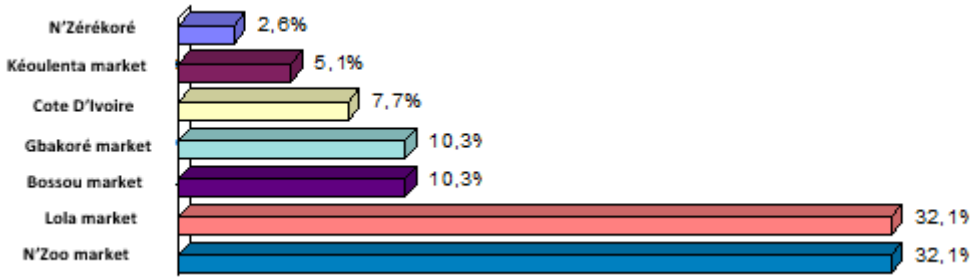

Figure5: Sources of supply

The Lola and N'Zoo markets (32.1%) are the strategic supply points for the populations living near the UNESCO heritage site, followed by the Bossou and Gbakoré markets (10.3%), while Côte d'Ivoire remains the supplier area for fungicides and fertilizers, subject to order.

For the application of phytosanitary products, the periods depend on the activities or

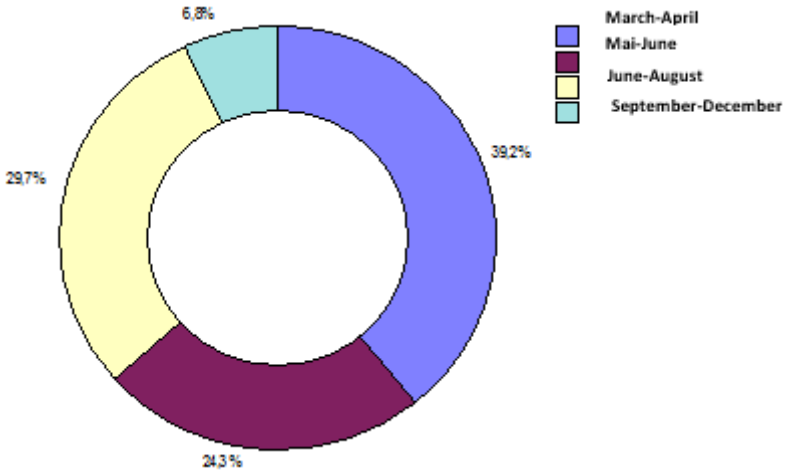

Figure 6: Periods of pesticide use

- March-April (39.2%), is the period which occupies first place during which land clearing is the main activity;
- June-August (29.7%) and May-June (24.3%) are the weeding periods with selective Herbi;
- September-December (6.8%) is the period devoted to market gardening activities.

3.5- Risks or effects of the irrational use of pesticides on human health

It should be noted that the evaluation of the health effects of pesticides is a complex activity and difficult to interpret for several reasons. Users of phytosanitary products recognize the toxicity of these products, but this assessment leads to confusion at their level or due to ignorance of the product. Which confirms the idea [6] of O. Samuel et al., 2019 which says that it is important to remember that the evaluation of the health effects of pesticides turns out to be a complex exercise which lends itself to ambiguity for several reasons. First, the intrinsic toxicity of different plant protection products varies considerably depending on the product.

Several illnesses are likely to be linked to the use of pesticides, the symptoms most often recognized by users are headaches, sore eyes, vomiting, general fatigue, etc. It should be noted that the symptoms of pesticide poisoning are rarely observed these days; users or the population working in the agricultural sector are the most exposed to the risks or effects of poisoning during the handling of these products. The dangers of pesticides on the environment are numerous, they drive away animals by modifying or poisoning their habitats. In addition to killing the target species, they can also contaminate and kill other species (insectivores, herbivores) which eat the already contaminated species. This statement confirms that of [4] P. Auger, 2014, who says that what is toxic to insects and certain plants can also affect human health and constitute a danger for workers exposed to these poisons.

The factors which increase the rate of poisoning are numerous, including among others: the intrinsic toxicity of the product, the dosage of use, poor handling, t wearing of protective equipment, etc.

A user who mixes the pesticide while smoking

A rice field being sprayed with herbi-selective for weeding in Bossou

Figure7

3.5.1-Different diseases linked to the use of pesticides

Although pesticides are important and necessary to facilitate agricultural activities, farmers nevertheless recognize certain diseases linked to the use of pesticides.

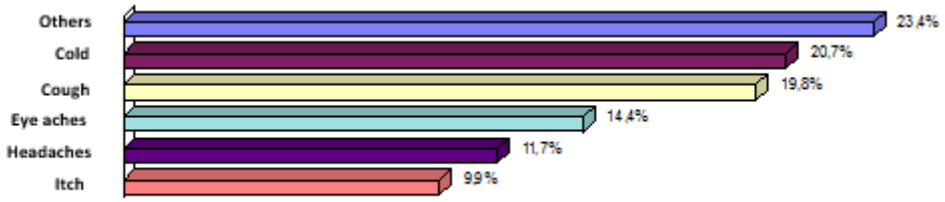

Figure8: Diseases linked to pesticide use

From this graph, we notice that other illnesses (vomiting, nausea, fatigue, loss of appetite, etc.) are the most frequent and which manifest themselves immediately according to users, followed by the common cold (20.7%) and itching or irritation. of the skin occupies last place (9.9%).

3.5.2- Prevention of diseases linked to the use of pesticides

Pesticides are poisons to kill weeds, insects and they contaminate the air and waterways. Which allows us to say without doubt that they can also affect the health of users (farmers who are often exposed to these poisons). Aware of this fact, they rely on protective equipment (nose mask, gloves, glasses, helmet, pair of boots, etc.) whose correct use makes it possible to limit the risks of these poisons but, due to lack of information these materials are omitted or used by preference (See figure 8).

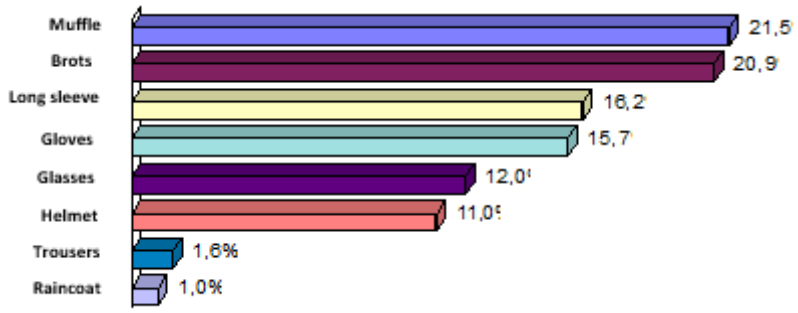

Figure9: Protective equipment before handling pesticides

The analysis of this figure allows us to say that the nose mask is the most used material, based on their opinion, it is inhalation of the product which is at the root of all the ailments from which they suffer and which causes the problems breathing, nausea, vomiting.As a remedy or preventive treatment for these ailments, the farmers who are the main handlers of these pesticides offer the following treatments: bathing, washing equipment after use, drinking red oil, drinking milk, eating charcoal, etc.

3.6- Toxicity of pesticides on human health and the environment

It should be remembered that pesticides have an intrinsic toxicity which depends on the manufacturing plants but, to this must be added the application dose, the quantity to be applied per crop, the management of containers or packaging.

For the application or spreading rate and the quantity to apply per crop, read the instructions on the labels or seek advice. Packaging management should follow the instructions on the labels or seek advice from the authorities in charge because some pesticides are highly flammable and should not be burned.

It should be noted that the effects of pesticides on human health and the environment are mainly due to the following factors:

- Failure to wear protective equipment;

- Failure to follow the instructions on the labels;

- The quantity used and its method of application;

- Poor management of packaging after use which causes contamination of water, air, animals, etc.

3.7 Impacts of pesticides on fauna, flora and the environment

If pesticides are used to facilitate field work and save working time, it follows that the irrational use of pesticides negatively impacts wildlife through the destruction of their habitats and the pollution of their living spaces, thus forcing flight. or the removal of animals and insects from their natural environments (decrease in the population

of insects, earthworms, etc.).

The fight against weeds and other nuisances leads to the loss of natural plant cover, giving way to invasive species. Medicinally valuable plant species that have saved lives in the past are disappearing in areas that regularly receive pesticides. The most serious is the disappearance or extinction of certain plant species.

Waterways and soil are polluted and degraded from their original quality by the irrational use of pesticides, the quality of the crops grown on site is degraded by pesticide residues in the soil, thus affecting the health of consumers. and the environment.

3.8 Constraints and limitations of the study

This work is the fruit of hard work by researchers at the Nimba Mountains Scientific Station (SSMN) during which constraints were observed, among which we cite:

- ✓ The illiteracy of the respondents;
- ✓ The reluctance of some respondents to take the questionnaires;
- ✓ Lack of experience and appropriate techniques in the manufacture of green manure (biofertilizers); etc.

All these constraints constitute limiting factors in the present study.

4.Conclusion

At the end of this research work, we reached the following results:

✓ Approximately 42 phytosanitary products (21 herbi-total, 11 herbi-selective and 9 insecticides) were encountered in the localities surrounding the site;

- ✓ Total herbicides (95.5%) for land cleaning, followed by selective herbicides (61.4%) used for weeding;
- ✓ Agriculture (40.8%) is the most practiced activity followed by livestock breeding (19.4%), hunting and gardening (9.7%), fishing (7.8%), carbonization (6.8%);
- ✓ The lowlands remain the cultivation zone par excellence (42.9%) where pesticides are used more, followed by the hills (38.1%) which receive food crops or substances while the plains (19.0 %) are occupied by perennial plantations;
- ✓ The markets of Lola and N'Zoo (32.1%) are the strategic points of supply of products followed by the markets of Bossou and Gbakoré (10.3%), while Côte d'Ivoire remains the area supplier of fungicides and fertilizers, subject to order;
- ✓ The March-April period (39.2%), is the period which occupies first place while June-August (29.7%) and May-June (24.3%) are the weeding periods with Herbi selective;
- ✓ On the other hand, September-December (6.8%) is the period devoted to market gardening activities

The rate of risks linked to the use of pesticides is due to non-compliance with the instructions for the use of these products, lack of information on pesticides, failure to wear protective equipment, negligence or users' ignorance

of the toxicity of pesticides.

Bibliographical References

[1]- J. N. AUBERTOT et al. Pesticides, agriculture and environment Reduce the use of pesticides and limit their environmental impacts, 2005.

[2]- FAO, "Urban agriculture and food security," Food and Agriculture Organization, 03 06 2005. Online, Available: http://www.fao.org/newsroom.

[3]- MELCC, Pesticides: impacts of persistent contamination, online at reseaufemmesenvironnement.org. 2O21.

[4]-P. Auger, The effects of pesticide use on health. Online uttam.quebec, 2014.

[5]- C. Sattler, et al., "Assessing the intensity of pesticide use in agriculture" Agriculture, Ecosystems and Environment, 2006; flight. 119, n°3, pp. 299-304,.

[6]- O. Samuel et al., The health risks of pesticides and action to reduce their impacts. Environmental Health and Toxicity Branch. National Institute of Public Health Quebec. 2019.

[7]-S. Piet et al., Storage of agricultural products. Agromisa Foundation and CTA, Wageningen; 2011, Agromisa ISBN: 978-90-8573-124-5, CTA ISBN: 978-92-9081-444-3

[8]- Ministry of the Environment and Sustainable Development, Republic of Senegal, Feasibility study of the Agropole Center in Senegal. Pest and Pesticide Management Framework Plan (PCGPP); IDEACONSULT International – SACI Senegal. 2021.

[9]- M. G. Haya, Assessing the impact of pesticides on the environment. INRA, Agronomy Station. BP 507, 68021 Colmar. 1997.

[10]- C. Sabbah et al., Reduce the use of pesticides and limit their environmental impacts. Collective scientific expertise, 2005.

[11]- Chantal Gagné, the use of pesticides in agriculture, Quebec. 2007.

[12]- A. Scheyer, Development of a GC/MS/MS analysis method for 27 pesticides identified in the gas, particle and liquid phases of the atmosphere, PhD, Strasbourg: Louis Pasteur University. 2004.

[13]- P. Garreau et al, The problem of agricultural pollution: its impacts on the health of waterways and on human health. "For a policy of transition to organic agriculture in Quebec", 1999.

[14]- PAN "Information document on pesticide management in Senegal," Pesticide Action Network Africa,

Dakar. 2006.

[15]- Thiam A. and Sarre A. Pesticides in Senegal.Ed. PAN Africa. 2OO3. 43p

[16]- H. Diouf and R, Badji S. Pesticides and poverty. Information document on pesticide management in Senegal.Ed.PAN Africa. 2OO7. 52P.

[17]- S. J. ZOUDI et al, Challenges of access of family farms to agricultural innovations in West Africa: institutional and political implications, 2003b.

[18] A. Diop, Urban issues and territorial development in contemporary Africa, Paris: Karthala, 2008.

[19]- Third phase of the support program for village communities (PAVC3), Pest and Pesticide Management Plan (PGPP), 2015.

[20]- Final report, Morocco, Study on monitoring the effect of plagues on human health and the environment, 2015.

[21]- A. Diop, Diagnosis of use practices and quantification of pesticides in the Niayes area of Dakar (Senegal) Université du Littoral Côte d'Opale, 2013.

[22]- A. Fait et al., Prevention of health risks linked to the use of pesticides in agriculture. International center for Pesticide Safety, 2004.

[23]- J.P Déguine and Ferron. Protection of crops, prevention of biodiversity, respect for the environment, Cah, Agaric. 2006. Vol.15(3),307_311.

[24]- D. Doucouré, Agricultural Production Program in West Africa, Pest and Pesticide Management Plan, 2007.

[25]- M. P Wolanski, The negative effects of agrochemicals on migratory waterbirds in Africa. Rhenish Friedrich-Wilhelms University Bonn, Germany, 2011.

[26]- I. Baldi et al., Pesticides: Effects on health. (Research report), Inserm: Editions EDP Sciences, 2013, (ISSN: 1264-1782).

[27]- P. MOLOUMOU et al., Environmental Impacts of illegal anthropogenic actions in the Déré forest 2nd central area of the Nimba Mountains Biosphere Reserve, Lola Prefecture, 2011.