

Determinants Sustainability Elimination of Open Defecation in Rural Areas: Case of Bouaflé Department (West Central of Côte d'Ivoire)

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Abstract

The department of Bouaflé is increasingly faced with health problems related to inadequate family sanitation. This situation creates high risks of high mortality and morbidity. In order to help significantly reduce these risks, EAA has initiated a project to promote family sanitation, ecological sanitation latrines (EcoSan) and the reuse of its by-products in agriculture in several villages in this department. The objective of this study is to assess the sustainability of ecological sanitation in rural areas in the said department. In order to achieve this objective, in addition to the literature review, this study was part of a mixed approach mobilizing related techniques and tools. The results obtained revealed that full latrine coverage and hand hygiene are not effective in all households. The factors contributing to the maintenance of the status of end of defecation in the open air in rural areas, especially the use of by-products in agriculture, are problematic. However, some of the households using the hygienized human excreta (HHE) show that crops fertilized by HHEs grow faster, the leaves of the plants are greener, have larger grains and fruits with a good taste when ripe. In addition, they control several pathogens, particularly Swollen Shoot in cocoa plantations.

Keywords: Ecological sanitation, Rural environment, Hygienized human excreta, Biofertilizer, Open defecation, Bouaflé, Côte d'Ivoire.

1. Introduction

« As today, it was still estimated that nearly 1 billion people never used toilets or latrines and practiced open defecation », (Fonds des Nations Unies pour l'enfance (UNICEF) & Organisation Mondiale de la Santé (OMS), 2015, p. 24). « When water supply, sanitation and hygiene are inadequate, health is significantly affected », (OMS & UNICEF, 2016, p. 5). « Inadequate sanitation in a single small area can threaten an entire community by polluting the water supply infrastructure and spreading intestinal worms, diarrhoea, cholera, dysentery, hepatitis A and polio », (OMS & 2018, p. 48). Sanitation in urban and rural areas is now becoming a worrying issue for African States where, for several years now, there has been increasing urbanization and a significant spatial densification of the population. « In Côte d'Ivoire, access to sanitation in rural areas is very low. Indeed, only 11% of the rural population has access to improved sanitation facilities while 48% do not have any and practice open defecation », (MICS, 2007, p. 80 ; PND, 2012, p. 28). Moreover, for these authors, « the lack of financing for the sanitation sector, especially in rural areas, is the cause of this situation. However, a large number of people living in poverty live in these sometimes-isolated communities », (PND, 2012, p. 80).

« In order to sustainably face the many challenges of the millennium concerning sanitation issues, the international community has adopted ecological sanitation (EcoSan) as an alternative for improving the living environment and health, especially of vulnerable populations, by giving an added value to sanitation products », (Gnagne & al., 2007, p. 38; N'goran, 2007, section Introduction par. 3). According to Allade & al.,

« Community Led Total Sanitation (CLTS) is an integrated approach that aims to bring communities to end open defecation (EOD). CLTS involves helping a community analyze its hygiene and sanitation situation, leading to collective action to achieve EOD status. CLTS aims to bring about changes in the hygiene and sanitation behaviour of an entire community rather than building toilets on the basis of subsidies », (2018, p. 3). In fact,

« it is an approach that supports and empowers communities to become aware of their health status (particularly in relation to open defecation practices and the low level of sanitation in the village) and the related risks, so that they can take collective decisions to change practices and implement them without external financial support », (Protos, 2016, p. 2). Safe management of faecal discharges is therefore essential. Thus, in its objective to promote access to sanitation and improve agricultural production of households in rural areas, the Pan-African Intergovernmental Water and Sanitation Agency for Africa (WSA) has included the promotion of ecological sanitation (EcoSan) in its programmes. N'goran describes

« the main objective of EcoSan as that of sustainably improving the living environment of people in rural and peri-urban areas by reducing the persistence of waterborne diseases. In addition to this main objective, the EcoSan project proposes to improve food security and environmental protection through the promotion of organic fertilizers », (2016, p. 176). In

collaboration with UNICEF and the European Union, WSA has initiated and implemented the Sanitation Component of the Millennium Water and Sanitation Program (MWSP) in the Marahoué Region for the benefit of village communities.

The agricultural experiences tested with EcoSan products (hygienized human excreta) during the project in the department of Bouaflé showed that these sanitation by-products are good organic fertilizers. « Social acceptance of the use and/or handling of these products by rural populations is also observed », (EAA, 2012, p. 15). However, in view of the use of these by-products, it seems necessary to assess the sustainability of maintaining the status of end of defecation in open areas in rural areas in the department of Bouaflé (Côte d'Ivoire). Indeed, good hygiene practices are the simplest and most effective way to prevent the spread of disease. Changing hygiene practices requires concerted action with key stakeholders. This study is divided into three parts. Firstly, the socio-demographic and economic characteristics of households benefiting from the EcoSan approach will be described. Secondly, we will assess the end-of-use status of open defecation (EOD) of households having adopted the EcoSan approach in villages declared EOD. Finally, we will analyze the factors contributing to the maintenance or not of the EOD status in villages declared EOD.

2. Materials and Methods

2.1 Geographic and Social Scope

2.1.1 Geographic Scope

The study was carried out in the Marahoué region, more precisely in the department of Bouaflé. Specifically, it was carried out in villages. The choice of these villages was made according to the following criteria:

- villages declared only EOD (End of Open Defecation),
- villages near the town of Bouaflé
- accessibility of the villages.

A total of 10 villages out of the 38 beneficiaries of this project were selected. They are :

1. Djidjibakro;
2. Kouakoublékro;
3. Kouamékouassikro;
4. Pkétoukro;
5. Salifoukro;
6. Simporefla;
7. Sinfla;
8. N'gattakro;

9. N'gorankro;

10. Blanfla.

2.1.2 Social Field

The social field consists of delimiting the study population within a study area. The households concerned by this study are those that benefited from the CLTS/EcoSan approach during the Millennium Water and Sanitation Program (MWSP)-sanitation component implemented in Marahoué. The inclusion criteria concerned the head of the household (or his wife or a member of the household) who is over 18 years old. The head of household or his/her representative is for us the resource person able to provide us with useful information on the subject of study. A total of 120 households were selected in order to better appreciate the current hygiene and sanitation practices of the population (Urine deflection dry toilet (UDDT) and bidurs) and to assess the risks related to the handling of hygienized human excreta (HHE). In this study, the following socio-demographic characteristics of the surveyed households were taken into account:

- the size of the household;
- the sex of the interviewee;
- the age of the interviewee;
- the education level of the interviewee and
- the activity of the head of household.

2.2 Data Production

2.2.1 Hardware

Several materials were used in this study. These included:

- a summary map of recognition of the study framework;
- a Global Positioning System (GPS) to take the geographical coordinates (latitude and longitude) of the various works carried out and of the localities;
- a digital camera for taking pictures.

2.2.2 Methods

This study aims at analyzing the strategies mobilized by the residents of the villages benefiting from the CLTS / EcoSan approach of the PHAM project in the department of Bouaflé. Emphasis was placed on the importance of:

- full coverage in the latrine to check the status of completion of defecation in the open area (EOD) or on return from defecation in the open area (OD);
- the presence of handwashing facilities in every household;
- good handwashing practice;

- good hygienic practice for sanitation by-products;
- the actual use of human HHE beings as fertilizer by the population;
- agricultural benefits (cash crops, food crops and market gardening) derived from the valorization of HHE;
- households' opinion on the health and environmental risks associated with the use of USDT and HHE as a biofertilizer.

We took a quantitative approach. The quantitative study, it consists in measuring, evaluating the facts, it makes it possible to bring out the groups of common and coherent opinions.

2.2.3 Data Collection Techniques and Tools

In this study, data were generated using a number of quantitative research techniques and tools. Data collection techniques or instruments are « defined operating procedures that can be transmitted and successively applied under the same conditions adapted to the type of problem and phenomenon in question », (N'da, 2015, p. 124). This study will use the following data production techniques and tools: documentary research (using a reading grid), direct observation (using an observation grid, camera) and field survey (using a questionnaire).

2.2.4 Statistical Processing of Data

Data management and analysis followed several steps to better inform the needs of the study. It consisted initially of recording and storing data in an Access database. Then, the SPSS 17.0 software made it possible to codify the data stored in the database, to calculate the averages and proportions of the collected data and also to build the pie charts. Finally, the Excel 2013 software made it possible to process the crossed variables and to build bar charts.

3. Results

3.1 Socio-demographic Characteristics of Households

The socio-demographic characteristics of the households surveyed during our study are summarized in Table 1 below:

Table 1. Summary of respondent profile (N=120)

| Socio-demographic profile variables | Percentage |
|--|-------------------|
| Sex | |
| Female | 19,01% |
| Male | 80,99% |
| Age | |
| under 35 years old | 28,10% |
| 35-55 years old | 47,93% |
| 55 years old and over | 23,97% |
| Level of Education | |
| Out of school | 52,07% |
| Primary | 34,71% |
| Secondary | 9,92% |
| Superior | 3,31% |
| Profession | |
| Agriculture | 98,35% |
| Other activities | 1,65% |

Source: Survey data

The size of the households surveyed ranges from 1 to 30 persons per household, with an average of 9 persons per household. The identification of the heads of households shows us that there are 81% men against 19% women. As for the age distribution of heads of household, 47.93% of heads of household are between 35 and 55 years of age, 28.10% are under 35 years of age and 23.97% are over 55 years of age with an average age of 42 years. The level of education of the respondents is very low in the villages. In fact, more than half (52.07%) of the respondents are out of school. The group of schoolchildren splits into three. Firstly, we have 34.71% for respondents who have primary level. Next, 9.92% have secondary education. Finally, 3.31 % have the highest level in the 10 villages surveyed. The majority of heads of households (98.35%), have agriculture as their main activity. They grow Coffee and Cocoa, food and vegetable crops. On the other hand, we have 1.65% of the respondents who carry out other activities such as trade or work in the public service.

3.2 Tracking the Status of End of Open Defecation (EOD)

3.2.1 Full Coverage in Latrines

Inadequate access to adequate sanitation is a major health risk factor for poor, marginal and vulnerable populations, more than half of whom live in rural areas. The use of latrines is essential for EOD to take place. However, before they are used, they must exist. Figure 1 below summarizes the full latrine coverage of the villages surveyed.

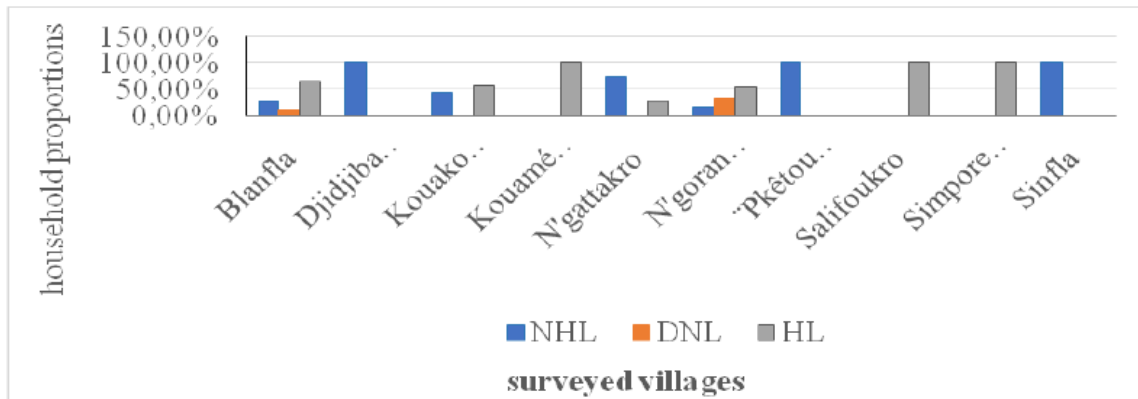


Figure 1. Full latrine coverage in rural areas in the Department of Bouaflé

NHL: does not have a latrine; DNL: defecates in the neighbour's latrine; HL: has a latrine

Source: Survey data

We have the villages of Djidjibakro, Pk êtoukro and Sinfla where the majority of households (100%) have no latrine. On the other hand, this percentage varies respectively in the villages of Blanfla, Kouakoubl êkro, N'gattakro, and N'gorankro from 27.27%, 43.48%, 73.33%, and 15.38% respectively.

The project in its implementation adopted the EcoSan approach. It has promoted the construction of dry pit latrines with urine diversion in families of more than 10 people. For example, not all families with fewer than 10 members had latrines built. They have to use the latrines built for neighbouring families. This situation is repeated in the villages of Blanfla with 9.09% and N'gorankro with 30.77%. These two percentages are those of people who use their neighbour's latrine. We can note that in the villages of Kouamêkouassikro, Salifoukro and Simpirefla, 100% of households have a latrine. As for the other localities, the proportions of latrine ownership per household vary from 63.64% in Blanfla, 56.52% in Kouakoubl êkro, 26.67% in N'gattakro and 53.85% in N'gorankro. Full latrine coverage is important when combined with hand hygiene.

3.2.2 Hand Hygiene

Hand hygiene is the essential measure to reduce infections. Hands are tools that interact with the external environment by coming into contact with and becoming colonized by pathogens (bacteria, microbes and viruses). Thus, hands are involved in the transmission of these agents. The practice of hand hygiene seeks to remove soil and help reduce or limit the risk of transmission of these agents. Clean hands can significantly improve the health of an entire family and reduce the incidence of common illnesses, including so-called dirty hand diseases. The practice of hand hygiene, more simply referred to as "handwashing", involves the application of a series of measures to keep hands clean.

The results of the interviews in our study, allow us to note the differentiated presence of handwashing devices.

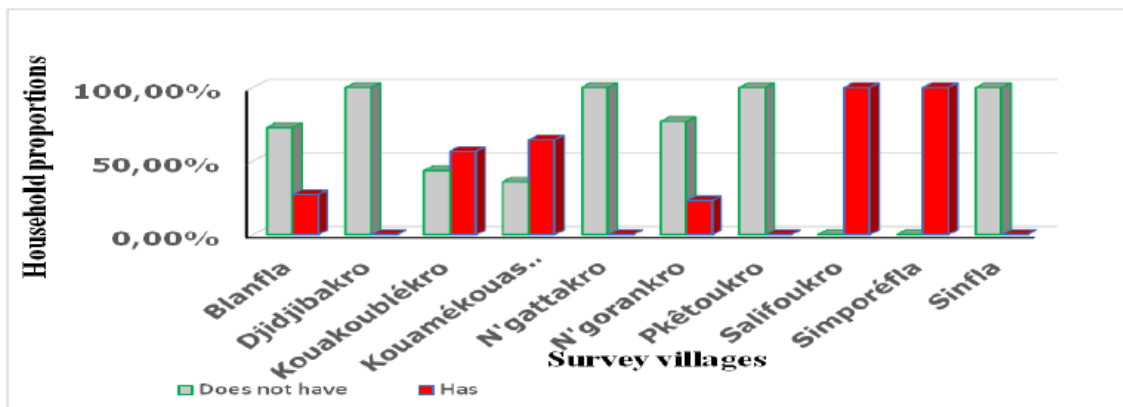


Figure 2. Proportion of households with handwashing devices in the villages surveyed

Source: Survey data

This study shows that in the villages of Salifoukro and Simporéfla, 100% of households have handwashing facilities. However, this percentage varies respectively in the villages of Blanfla with 27.27% of households, Kouakoublékro with 56.52%, Kouamékouassikro with 64.29%, and N'gorankro with 23.08%. However, in the villages of Djidjibakro, N'gattakro, Pkétoukro, and Sinfla, no households have handwashing facilities. However, is the presence or absence of handwashing facilities synonymous with hand hygiene in these villages in the field of our study. Figure 3 gives us a summary of the answers to this question.

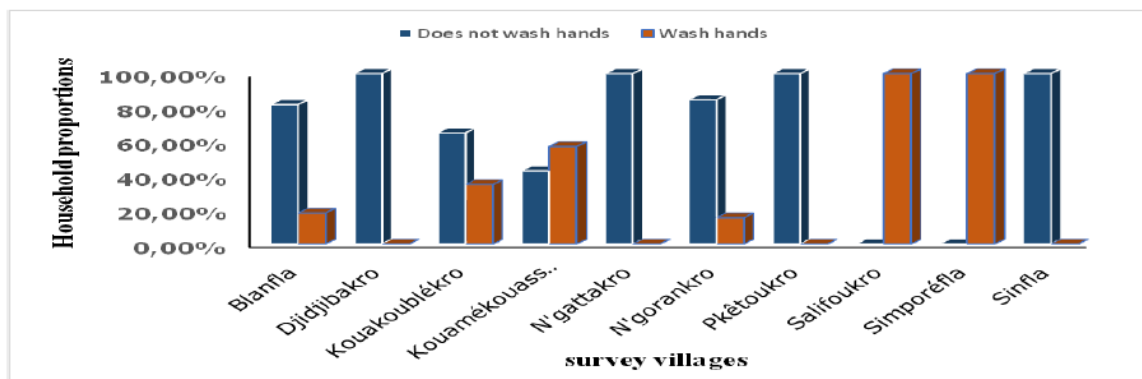


Figure 3. Proportion of households that wash their hands after using latrines

Source: Survey data

All households in the villages of Simporéfla and Salifoukro practice 100% handwashing after defecation. This practice of handwashing is also respected, but in different ways by households in the villages of Blanfla (18.18%), Kouakoublékro (34.78%), Kouamékouassikro (57.14%) and N'gorankro (15.38%). However, our study shows that not all of the households surveyed in the villages of Djidjibakro, N'gattakro, Pkétoukro and Sinfla practice hand

washing after defecation.

3.3 Factors Contributing to the Maintenance of FDAL Status

3.3.1 Hygienization of Human Beings

Substances released out of the body consisting mainly of waste products from food processing in the body, human excreta (HE) become improved after a hygienisation process. During this process, added value is added to human excreta, which becomes an agricultural product in the same way as chemical fertilizers and other phytosanitary products and is henceforth referred to as Hygienized Human Excreta (HHE). It should be noted that this hygienisation process takes place in EcoSan latrines, which are dry pit latrines with urine diversion. Urine by diversion is collected in a canister, while faeces are stored in two raised pits alternately. While one pit is in use, the second pit is left standing. As soon as the first pit is filled, it is closed for hygienisation while the second is opened for use. Is this hygienisation process correctly followed in the villages concerned? Figure 4 shows the answer to this question with regard to urine.

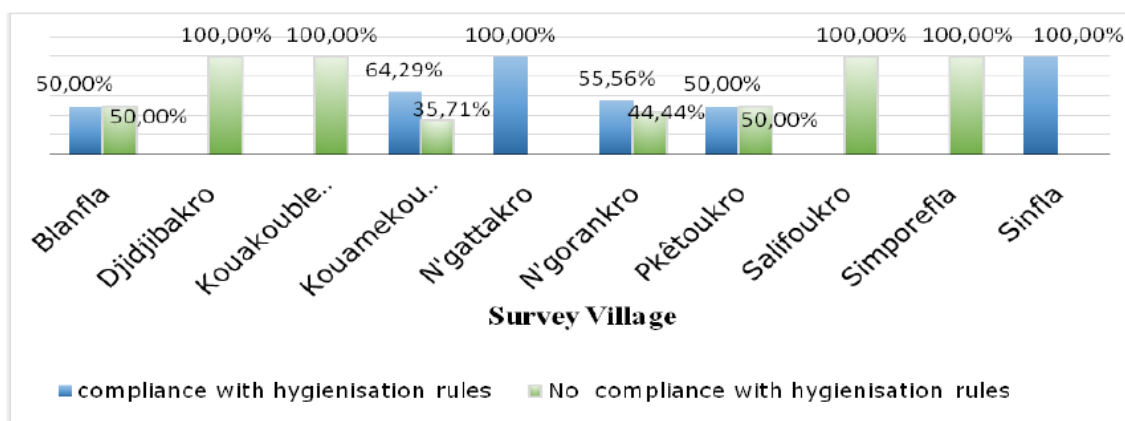


Figure 4. Proportion of households complying with urine hygienization rules

Source: Survey data

For good hygienization practice, Figure 4 illustrates the degree of compliance with the urine hygienization process by households in each village. The results show that the villages of N'gattakro and Sinfla are 100% respect with the urine hygienization process. The percentage of compliance with this process is 64.29% in Kouakoubl êkro, 55.56% in N'gorankro and 50% in Blanfla and Pkêtoukro. On the other hand, in the villages of Djidjibakro, Kouakoubl êkro, Salifoukro and Simporefla, almost all (100%) of the households observed do not comply with good urine hygiene practices.

Regarding faecal hygienization practices, the study shows that all households (100%) having acquired EcoSan toilets in all villages surveyed comply with the rules for faecal hygienization. Even if, the HHE is a new material that differs from Human Excreta with an additional agronomic value, are they used by rural populations? Figure 5 summarizes the

willingness to use or not to use human waste.

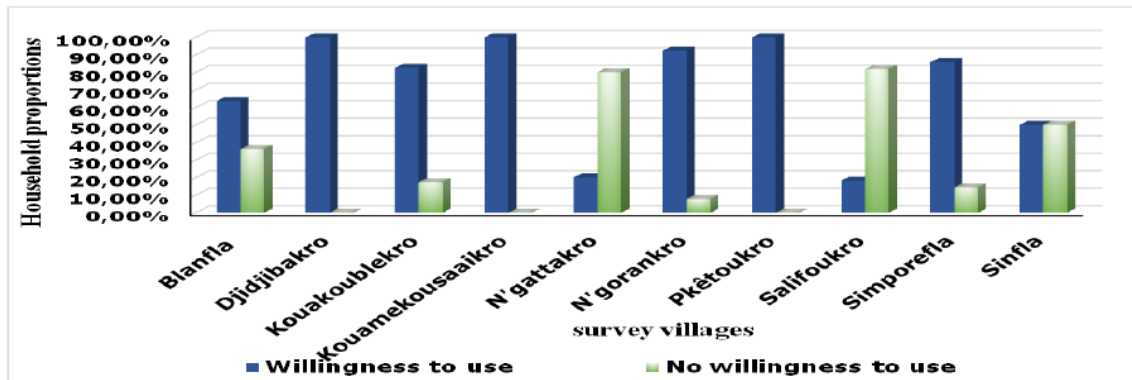


Figure 5. Degree of acceptance of the households surveyed to the use of HHE as biofertilizer

Source: Survey data

The perceptions developed by the rural populations of the villages surveyed on HE are transposed to HHE. As the HE are rejected because they are repugnant, they negatively influence the image of HHE. This is despite the fact that the hygienization process makes the human beings hygienic. Figure 5 illustrates the willingness of households to use HHE as a bio-fertilizer. Households in Djidjibakro, Kouamekouassikro and Pkétoukro accept 100% of the use of HHE as fertilizer in agriculture. On the other hand, this percentage varies according to the rest of the field villages in our study. These vary from 92.31% in N'gorankro, 85.71% in Simporefla, 82.61% in Kouakoublekro, 63.64% in Blanfla, 50% in Sinfla, 20% in N'gattakro and 18.18% in Salifoukro. Even though, although HHE is a new material that differs from HE, its acceptance as a fertilizer is problematic in the field. However, what about the use of HHE as fertilizer by the villagers?

3.3.2 Use of HHE

Does the use of HHE as bio-fertilizer lead to changes in the agricultural production of villages? Figure 6 summarizes the benefits listed by the villagers.

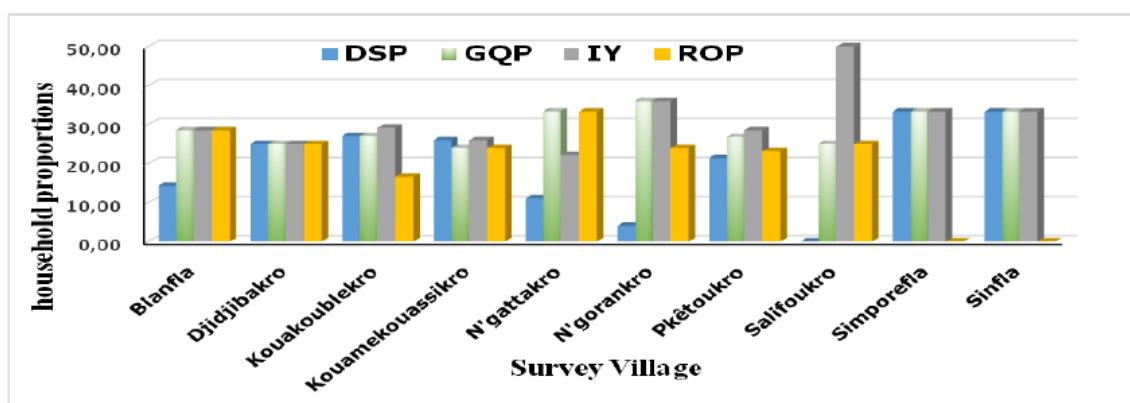


Figure 6. Benefits of HHE in agriculture in the surveyed villages

DSP: Disappearance of some pathogens; GQP: Good quality products; IY: Improves yield; ROP: Rejuvenation of old plants

Source: Survey data

Figure 6 shows us the results of the benefits observed by households using HHE in agriculture. These are subdivided under four headings:

1. Disappearance of some plant pathogens,
2. Good quality products,
3. Improves performance,
4. Rejuvenation of old plants.

According to the results of this study, households (33.33% in Simprefla and Sinfla, 27.08% in Kouakoubekro, 26% in Kouamekouassikro, 25% in Djidjibakro, 14.29% of households in Blanfla, 11.11% in N'gattakro, 4% in N'gorankro, 21.43% in Kp'atoukro) affirm that the use of HHE as a biofertilizer allows the disappearance of certain pathogens from crops. However, in the village of Salifoukro no household is of this opinion. Because they have not noticed any difference.

In the villages surveyed, another advantage of HHE was listed. Indeed, the EHH are described as a biofertilizer that allows to obtain good quality agricultural products. This is:

- 36% of households in N'gorankro,
- 33.33% of households in N'gattakro, Simprefla and Sinfla,
- 28.57% of households in Blanfla,
- 27.08% of households in Kouakoubekro,
- 26.79% of households in Pk'atoukro,
- 25% of households in Djidjibakro and Salifoukro,
- and 24% of households in Kouamekouassikro.

According to the respondents, a third benefit is also derived from the use of HHE as a biofertilizer. This is described as a product that improves plant yields. This advantage is confirmed by 50% of households in Salifoukro, 36% of those in N'gorankro, 33.33% of those in Simprefla and Sinfla, 29.17% of those in Kouakoubekro, 28.57% of those in Pk'atoukro and Blanfla, 26% of those in Kouamekouassikro, 25% of those in Djidjibakro, and 22.22% of those in N'gattakro.

In addition to the users of HHE, he discovered a fourth advantage. For them, the HHE promote the rejuvenation of old plants, especially those of the cocoa tree. Thus, do we have the different percentages of households per village that find that HHE have a rejuvenating

effect on their old plants. We therefore have N'gattakro for 33.33% of these households, Blanfla for 28.57% of these households, Djidjibakro and Salifoukro for 25% of these households, Kouamekouassikro for 24% of these households, N'gorankro for 24% of these households and Pkêtoukro for 23.21% of these households. However, in the villages of Simporefla and Sinfla, no household is of this opinion. Because no difference was found. The use of HHE as a biofertilizer is much appreciated by the households. The benefits that they derive from the by-products of the HHE favour the satisfaction of the households with the use of EcoSan facilities. Figure 7 presents the level of satisfaction of the beneficiaries of the EcoSan approach.

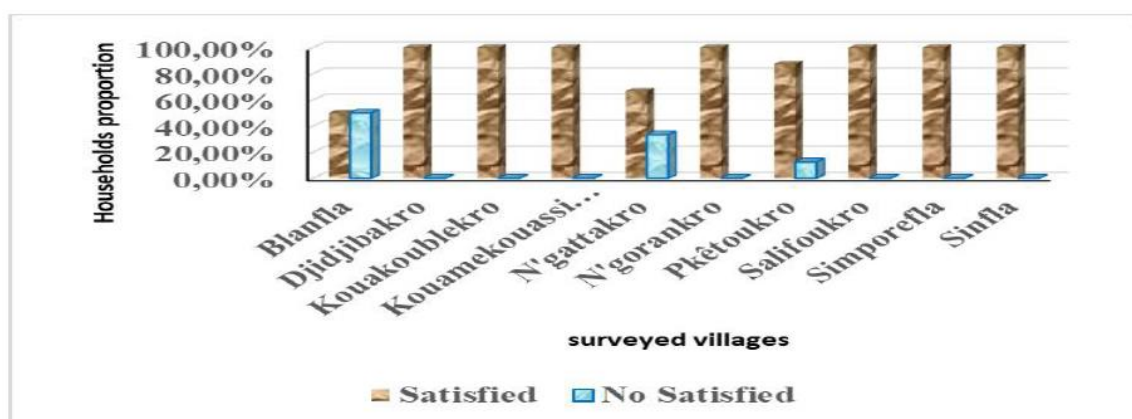


Figure 7. Satisfaction of EcoSan beneficiaries surveyed

Source: Survey data

Overall, the majority of households surveyed are satisfied with the 100% EcoSan approach in the villages of Djidjibakro, Kouakoublekro, Kouamekouassikro, N'gorankro, Salifoukro, Simporefla, and Sinfla. These are seven villages out of the ten surveyed. On the other hand, this percentage decreases in three of the ten field villages in our study. These vary from 87.50%, 66.67% to 50% are Pkêtoukro, N'gattakro and Blanfla villages, respectively.

4. Discussion

The results of this study showed that the majority of heads of households are men. In general, the heads of households (men or women) are of different age groups, with a dominance of those between 35 and 55 years of age and an average age of 42 years. Among these heads of household, the majority are illiterate (52.07%) and 98.35% of them practice agriculture for activity, as in most rural areas of Côte d'Ivoire. These results reflect the fact that

« the other members of the household are under the authority of men and that the department of Bouaflé today is made up of a constellation of subsocial groups, ethnic communities and formal or informal social classes and categories, which form more or less declared interest groups », (UVICOCI, 2016, section II-Historique).

At the end of this study, it appears that 43% of the households surveyed do not own a latrine,

while 4% use their neighbour's latrine. This condition could be explained by the destruction and collapse of superstructures that led households to abandon the works. Many households believe that the material used for the construction of USDT is of poor quality and can cause the collapse of the USDT s during use due to wind or termite action. Some say that the transport, handling of human excreta and the use of USDT are complex. Others argue that the pits are full and that there is insufficient funding for the construction of a new latrine. This observation also reflects the fact that the beneficiaries have not sufficiently appropriated the EcoSan approach and have not been able to sustainably manage the structures built for this purpose. « This raises the problem of supervision and monitoring of the achievements after the intervention of development projects », (Tinsakr é 2013, p. 11). This situation has led the majority of households to fall back into their old habit, which is open defecation in the open air. As a result, handwashing, which is an essential step in the process of improving personal hygiene, is not practiced by all households. It is done by 68.07% of them in the villages visited. In addition, we have 61.34% of the households that do not have handwashing facilities. According to these households, they do not find it necessary to do so, yet Banque Mondiale (BM) & al. indicates that « handwashing is the first step to be taken to improve the health status of latrine users », (2007, p. 10).

However, the approach is widely (71%) socially accepted by all households who have realized that excreta should no longer be considered as waste but rather as wealth. Indeed, some households collect urine in jerry cans for fertilization of fields despite the absence of USDT. The same observations have been made in Dabou (Como é & al., 2009, p. 32; N'goran & al., 2016, p. 146), Ferk é s é dougou (CREPA-CI, 2012; p. 39), and in some countries of the West African sub-region (CREPA, 2006a, p. 12). Regarding urine hygienisation techniques, 62% of village households using urine as a biofertiliser do not comply with them because once the cans are filled, they are used directly in the field. This behaviour is contrary to the rules of urine hygienisation. Indeed, according to CREPA, for good hygienisation, drums should be hermetically sealed once filled and put in the shade « for a minimum period of 30 days. The hygienisation of human excreta before their use as biofertiliser in agriculture limits the risk of contamination to humans, crops and soil », (2006b, p. 45). As for faeces, the majority of households (100%) in the villages surveyed have complied with the hygienic rules. When used for the first time, the households surveyed generally found the absence of flies and foul odours. This observation is confirmed by CREPA which showed that, when properly hygienized, these products (faeces) are not harmful to humans and their environment. Indeed, « the use of ash helps dehydrate faeces and facilitates the elimination of pathogenic bacteria. This elimination of pathogenic bacteria is also promoted by the burial of faeces for composting, which requires a period of 5 to 6 months », (2006b, p. 10-11). The study showed that faeces and urine are quality biofertilizers. According to households, crops fertilized by these hygienized human excreta (HHE) have faster growth, greener leaves, larger grains and fruit with a good taste when mature. These results are in line with those of Como é (2009, p. 32-33) on the fertilization of yam and cassava fields with urine and Adamou (2010, 3.1 R é sultats) on the fertilization of millet. In addition, households report that these biofertilizers control certain plant diseases, particularly Swollen Shoot in cocoa plantations.

5. Conclusion

This study assessed the sustainability of maintaining open defecation status in rural areas in the department of Bouaflé. However, the study showed that a small portion of the surveyed population does not have access to latrines and hand washing facilities. These situations have led many households to return to their old habits, which is the practice of open defecation. The survey showed that despite the destroyed latrines, in general 61% of the households surveyed use the bidur. The results of the good practice of human excreta hygienization reveal that more than half (62%) of the households visited do not respect the time limit for urine hygienization, while 38% respect it. Nevertheless, the hygienisation of faeces is 100% respected. Households attest that the use of hygienized human excreta as a biofertilizer improves the yield and quality of agricultural production, rejuvenates old plants and is an effective remedy against Swollen Shoot disease. Households are generally satisfied with the EcoSan approach. Taking into account the difficulties encountered during this study, it is advisable to carry out visits at least once every two months to assess the acceptance of the project, to use good quality materials for the construction of latrine superstructures for future projects, to build EcoSan hot plate latrines to facilitate the collection and transport of faeces for future projects in rural areas, and to carry out in-depth studies on the effects of using urine as a biofertilizer on cocoa plants.

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