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# Analysis of soil fertilization practices by market gardeners and their perception of the use of compost based on mango residues in the commune of Korhogo, northern Ivory Coast

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***Abstract***— *Market gardening is a key source of income and food security for households in Korhogo. With urban expansion, pressure on soils has increased, leading to declining fertility and threatening production sustainability. This study aimed to assess current fertilization practices and explore the potential of mango residue compost as a local alternative. A survey of 72 producers across six urban and peri-urban sites—mostly women—focused on crops, fertilizer types, application methods, and constraints. Results show that 93% use chemical fertilizers, mainly NPK (88%), while only 28% use organic inputs and less than 10% use compost. Microdose application is common, helping reduce leaching. Major constraints include poor soils, irregular rainfall, and pests. Despite limited adoption, producers expressed strong interest in mango compost due to its local availability. Barriers include lack of information, technical skills, and equipment. These findings highlight the need for simple, adapted solutions. Developing a local composting system based on mango residues could improve soil health and reduce reliance on chemical inputs.*

***Keywords***— ***Investigation, Fertilizers, Soil fertility, Market gardeners, Korhogo, Ivory Coast***

## I. INTRODUCTION

Agriculture is a major economic sector worldwide, employing more than 40% of the working population, and up to 52% of this population, generally, in Africa [1]; [2]. In Côte d'Ivoire, as in many sub-Saharan African countries, it plays a key role in socio-economic development. Among its many branches, urban and peri-urban market gardening plays an essential role in food supply in Africa [3]. The department of Korhogo is distinguished by its flourishing market gardening activity, driven by pedoclimatic conditions favorable to the cultivation of several vegetables, such as eggplant, chili pepper, okra, onion and tomato [4].

Intra-urban market gardening represents both an economic survival strategy for vulnerable urban populations and an expression of their socio-cultural identities through agricultural practices. Settled in precarious spaces, such as lowlands, wastelands and dam areas, producers demonstrate resilience in the face of urban pressure and land uncertainties [5]. Market gardening in Korhogo is developing mainly in urban lowlands, due to their accessibility, water availability and increasing land pressure linked to the expansion of the city. [6], thus leading to the development of urban and peri-urban agriculture [7]. However, this intensification is not without consequences: like the trends observed in other parts of Côte d'Ivoire [8], where soils are subject to continuous exploitation, which leads to their degradation and the progressive decline of their fertility [7]. This situation is even more accentuated in Korhogo, where the exploited soils are, mainly, sandy, poor in organic matter and facilitate the leaching of mineral elements, which pushes market gardeners to resort to frequent applications of chemical fertilizers [9]. In this

context, sustainable soil fertility management has become a crucial issue for the sustainability of market gardening production systems in the region. This study, whose general objective is part of an approach to analyzing local agricultural practices, aims to introduce the use of compost from mango residues as an alternative solution to improve soil fertility by studying the diversity of fertilizer types and the variability of doses applied under market gardeners in the city of Korhogo. Through a survey conducted among market gardeners in Korhogo, it will examine several essential aspects: the different types of fertilizers used (i), the constraints linked to market gardening production (ii), as well as the perception of producers regarding the use of rejected mangoes for the manufacture of compost (iii).

## II. MATERIALS AND METHODS

### Study area

The study was conducted in the city of Korhogo, located in the north of Côte d'Ivoire, with geographical coordinates of 9° 26' north longitude and 5° 38' west latitude. Its climate, of the Sudanese type, is characterized by the alternation of two seasons: from October to April, a long dry season, followed by the rainy season, marked by two peaks of water precipitation in June and September. Annual precipitation varies between 1100 and 1600 mm of water, while sunshine reaches approximately 2600 hours per year. Local climatic conditions include average temperatures, ranging from 24 to 33 °C, as well as an average monthly humidity of 20%. The natural vegetation is dominated by savannah, which can be sometimes grassy and sometimes wooded. The soils of the region are of the tropical ferruginous type, formed on granite. These soils, more or less leached, have a low water retention capacity, a very acid pH (4.7) and low nutrient content, which considerably limits their fertility and agricultural potential [10]. The study sites are distributed in several areas in the city of Korhogo: in the south (Logokaha, Téguéré), in the southeast (Kassirimé), in the northwest (Cocody) and in the west (Haoussabougou and Koko) (figure 1).

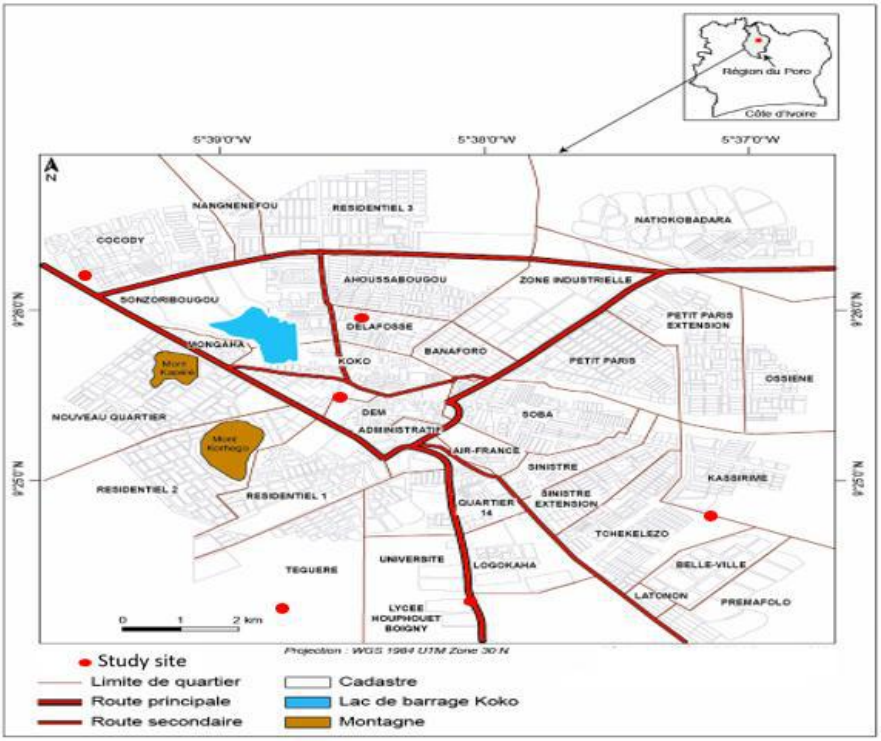


*Fig.1: Presentation of study sites*

### Plant material

The survey focused on producers of different market garden crops, representative of local agricultural practices in the study area. The main species cultivated by these market gardeners were tomato (*Solanum lycopersicum*), eggplant (*Solanum melongena*), cabbage (*Brassica oleracea*), okra (*Abelmoschus esculentus*), chili pepper (*Capsicum spp.*) and lettuce (*Lactuca sativa*). *These* market garden crops play an essential role in urban and peri-urban agricultural production in the city of Korhogo. They are particularly grown in the lowlands of the city, especially around Lake Koko and on undeveloped land, due to the strong land pressure caused by the strong population

expansion [9]. Women (up to 98% of producers) mainly carry out this activity.

**Technical equipment**

The study relied on survey forms, including both closed and open-ended questionnaires, as well as semi-structured interview guides. The questionnaires allowed for the collection of quantitative data on the practices and perceptions of market gardeners, while the semi-structured interviews provided the opportunity to explore certain aspects in more depth and to collect detailed qualitative information. The questionnaires were submitted to market gardeners in the city of Korhogo.

**Methods**

This study used a methodological approach, combining a field survey, with the use of guides and questionnaires, as well as semi-structured interviews. The survey took place from July 22 to 25, 2024, with 72 market gardeners, spread across six districts of the city of Korhogo: Cocody, Haoussabougou, Koko, Kassirimé, Téguéré and Logokaha. A sample of 12 market gardeners per district was selected, in order to ensure representativeness of the different production sites. Each producer was questioned individually about his cultivation practices directly on his plot, in order to ensure the existence of his plot. The interview addressed several essential aspects, linked to market gardening practices. These were:

- fertilization which concerns the different market garden crops grown, the types of fertilizers used (mineral or organic), the justifications for the choice of these fertilizers, their availability and their methods of application, the quantities or doses applied and the periods and frequencies of application of the fertilizers.
- The constraints focused on the main difficulties encountered by producers, in particular, soil fertility and the destruction of crops due to pests and diseases, as well as the lack of rain.
- Composting of mango residues revolved around the level of knowledge of producers about making compost from abandoned mangoes, as well as their perception of using compost as an alternative to chemical fertilizers.

**Statistical analyses**

Sphinx Plus software was used for the design and entry of questionnaires. The quantitative data collected were analyzed using SPSS version 26 software, while the qualitative data, from the semi-structured interviews, were processed using a qualitative analysis method. Microsoft Excel software was used for the design of tables and figures.

## III. RESULTS

**Types of fertilizers used**

The study identified the different types of fertilizers used by market gardeners in the six localities (Figure 2). Analysis of the results revealed a clear preference among market gardeners for chemical fertilizers over organic fertilizers, with usage rates varying between 58.81% and 87.15%, depending on the locality. Indeed, the locality of Haoussabougou showed the highest rate (87.15 %), followed by Logokaha, where the use of chemical fertilizers exceeded 82.12%. However, despite this predominance, Kassirimé and Cocody showed slightly lower proportions compared to other areas, respectively, 58.81% and 67.03%.

Regarding organic fertilizers, Kassirimé stood out, with the highest proportion (41.19%). Conversely, Haoussabougou, which showed the highest use of chemical fertilizers, also presented the lowest proportion of use of organic fertilizers (12.85%), as did Logokaha (17.88%), where their use remained very minimal.

**Chemical fertilizers**

**Different types of chemical fertilizers encountered**

The analysis revealed that the most commonly used types of fertilizers by market gardeners are NPK, urea and foliar fertilizers (Figure 3). NPK fertilizer was largely dominant, with an average usage rate of 74.90 %, compared to 4.10% for urea and 21 % for foliar fertilizer, and this in almost all localities. Some areas showed marked trends in the use of chemical fertilizers. Cocody, Kassirimé and Logokaha recorded the highest rates of NPK use, reaching 83%. Urea, on the other hand, is used with a very low proportion in all areas, with particularly low rates in Cocody, Kassirimé, Téguéré and Logokaha. However, Haoussabougou and Koko had slightly higher rates (8.30%), although they remained below the average. Foliar fertilizer, used more than urea, varied more, depending on the locality. Koko recorded the highest rate (33.30%), followed by Haoussabougou (16.70%) and Cocody (25%). In contrast, Kassirimé, Téguéré and Logokaha had the lowest rates of use (17%).

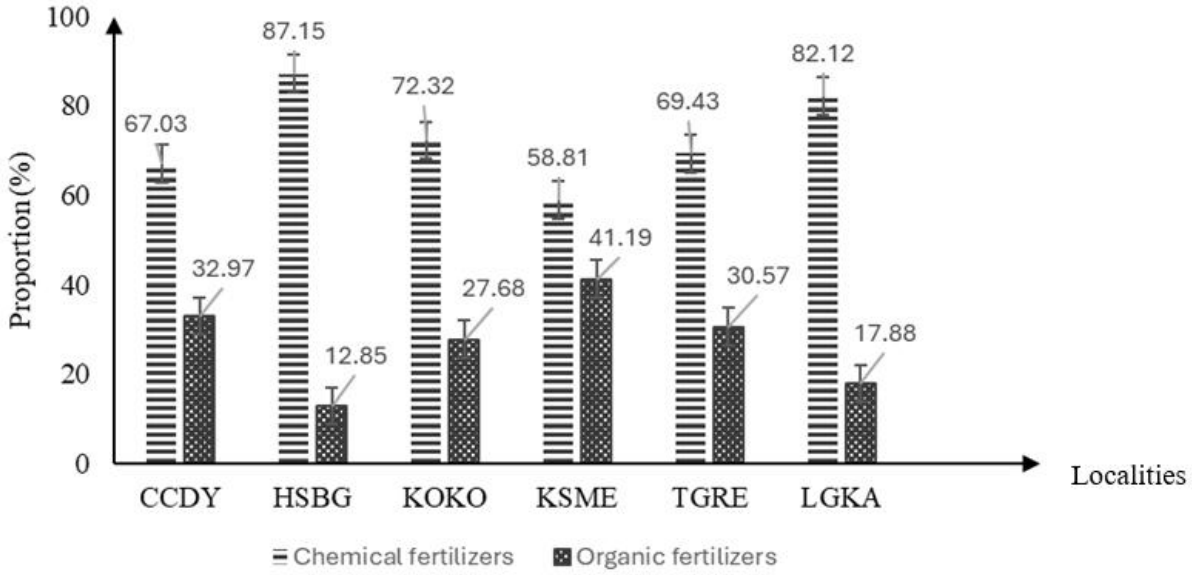


*Fig.2: Different types of fertilizers used by market gardeners*

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

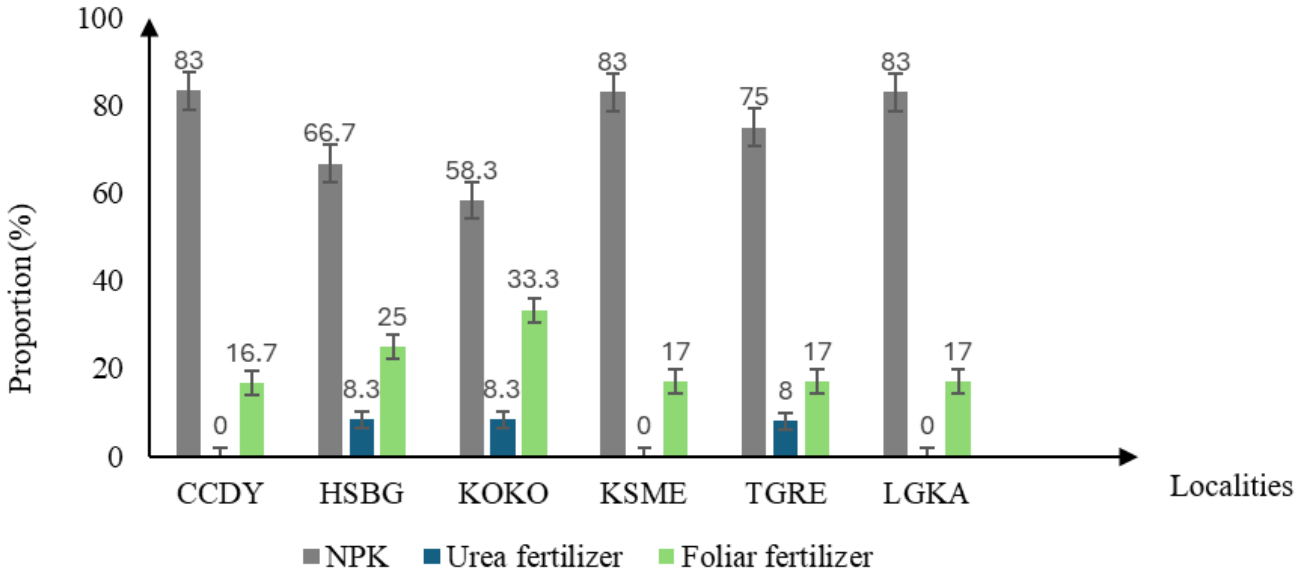


*Fig.3: Different chemical fertilizers used in market gardening areas*

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**Methods of spreading chemical fertilizers**

The market gardeners surveyed apply different methods of spreading chemical fertilizers, including microdose, broadcast spreading, and side spreading (Figure 4). However, the study revealed that only the first two are actually used in the field. Microdose spreading is the dominant technique, with an average use of 75% across all market gardening areas surveyed. The localities of Téguéré and Koko recorded the highest rates, reaching 91.70% and 83.30% respectively. On the other hand, broadcast spreading remained marginal, with an average of 25%, although some areas such as Haoussabougou (41.70%) and Kassirimé (33.30%) stood out for relatively higher adoption. Conversely, the lowest proportions for this method were observed in Koko (16.70%) and Téguéré (8.30%). As for lateral spreading, it was not practiced in any of the areas studied (0%).

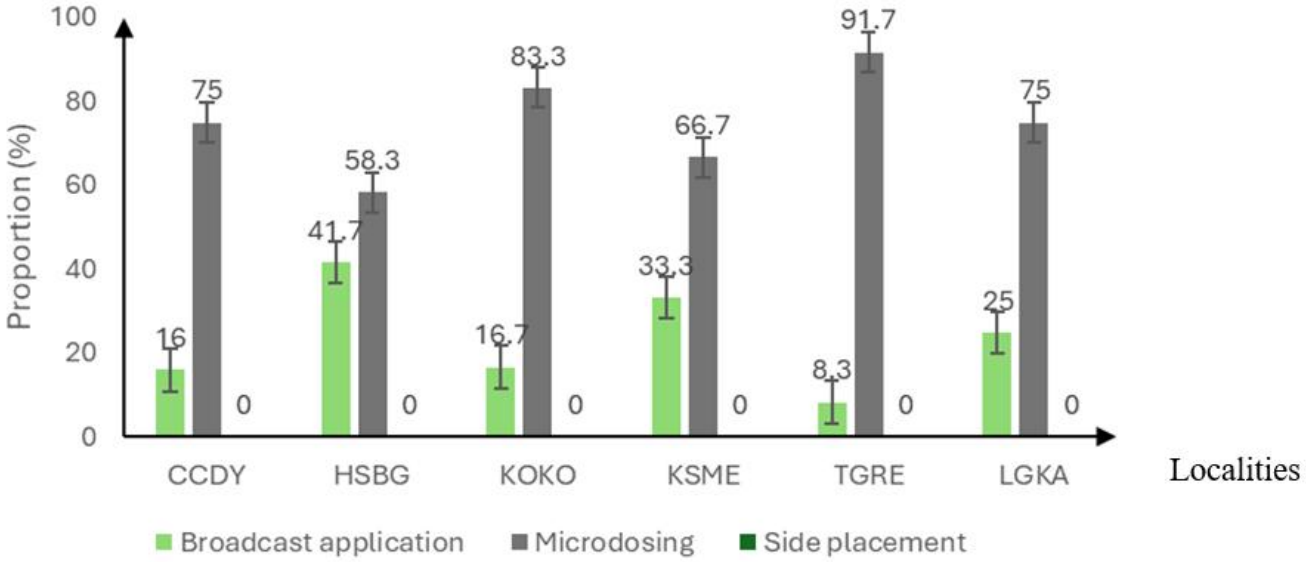


*Fig.4: Methods of spreading chemical fertilizers according to the zones*

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**Periods of application of chemical fertilizers**

The periods of application of chemical fertilizers after transplanting are mainly divided into two key moments: two weeks (02SAR) and three weeks (03SAR) after transplanting as detailed in Table 1. Analysis of the results revealed that the majority of market gardeners (69.40%) applied chemical fertilizers at 02SAR. This practice was largely predominant in most localities. The market gardening areas of Téguéré and Logokaha recorded the highest rates of application at 02SAR (91.70% each), followed by Koko (74.60%). Furthermore, Haoussabougou and Kassirimé also showed a strong preference for this method, with a rate of 58.30% in both localities. However, application at 03SAR was generally lower, although it varied depending on the areas studied. Indeed, Cocody was an exception, being the only locality where application at 03SAR (58.30%) exceeded that at 02SAR (41.70 %). In addition, Haoussabougou and Kassirimé showed average application rates at 03SAR (41.70% each), while Koko showed a relatively low rate (25.40%). On the other hand, the areas of Téguéré and Logokaha showed very low application rates at 03SAR (8.30% each).

*Table 1: Periods of application of chemical fertilizers according to the zones*

| | Proportion (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| Period | CCDY | HSBG | KOKO | KSME | TGRE | LGKA | Average |
| 02SAR | 41.7 | 58.3 | 74.6 | 58.3 | 91.7 | 91.7 | 69.4 |
| 03SAR | 58.3 | 41.7 | 25.4 | 41.7 | 8.3 | 8.3 | 30.6 |

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha, 02SAR: two weeks after transplanting; 03SAR: three weeks after transplanting

**Doses of NPK provided by market gardeners**

The different doses of NPK applied by market gardeners in their farms, according to the localities studied, is illustrated in Figure 5. The analysis revealed that the dose of 40 g/plant was more frequently applied, representing 55.32% of applications, compared to 44.67% for the dose of 20 g/plant. This preference for 40 g/plant was particularly marked in Koko, Kassirimé, Téguéré and Logokaha, where its use exceeded that of 20 g/plant. In the locality of Kassirimé , the dose of 40 g/plant was mainly applied by market gardeners (75%), compared to only 25% who opted for the dose of 20 g/plant. However, some localities, such as Cocody and Haoussabougou, were an exception to this trend and recorded a preference for the 20 g/plant dose. This dose was used predominantly with 58.30% of cases in both areas. Thus, this analysis highlights an overall preference for the 40 g/plant dose although some areas, notably Cocody and Haoussabougou, have favored the application of 20 g/plant.

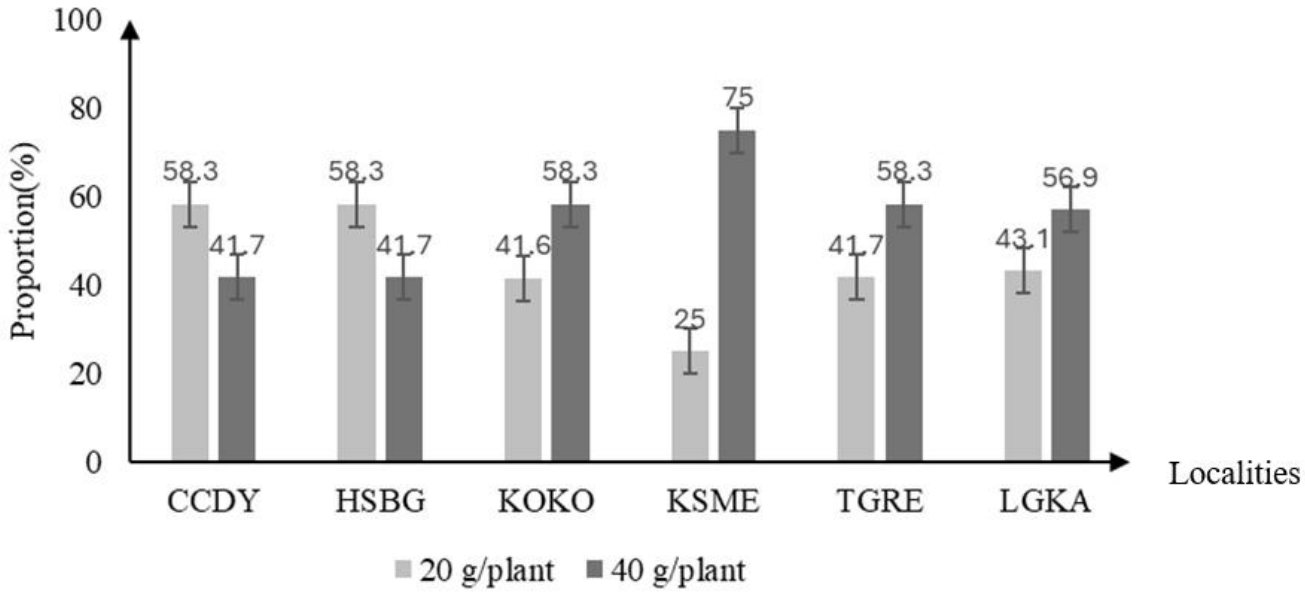


*Fig.5: Doses of NPK applied per pocket depending on the areas*

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**NPK Fertilizer Application Frequencies**

Regarding the frequency of application of NPK fertilizer, two main methods were noted among market gardeners, namely, a single application and two applications per crop cycle, as shown in Table 2. The results of the analysis indicated that the practice of making two applications of NPK fertilizer was more frequent, with an average rate of 55.32%, compared to 44.68% for the single application. However, differences were observed between localities. In Kassirimé , the frequency of applying NPK fertilizer twice out of the two applications was largely dominant, reaching a rate of 83.30%, compared to only 16.70% of market gardeners who opted for a single application. Furthermore, market gardeners in the localities of Téguéré and Logokaha also favored a frequency of two applications of NPK fertilizer, with respective rates of 58.30% and 56.90%. Conversely, market gardeners in the Cocody and Haoussabougou areas mostly opted for a single application of NPK fertilizer, with a rate of 58.30%, while those in the Koko area showed a more balanced distribution between the two practices. This analysis reveals a general trend in favor of double application of NPK fertilizer per crop cycle.

*Table 2: NPK application frequencies during the crop cycle*

| | Proportion (%) | | | | | |
|---|---|---|---|---|---|---|
| Frequency | CCDY | HSBG | KOKO | KSME | TGRE | LGKA |
| 01 times | 58.3 | 58.3 | 50 | 16.7 | 41.7 | 43.1 |
| 02 times | 41.7 | 41.7 | 50 | 83.3 | 58.3 | 56.9 |

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**Organic fertilizers**

**Different types of organic fertilizers encountered**

The different types of organic fertilizers encountered in the market gardening areas studied are cow dung, poultry manure and compost, as presented in Table 3. The survey results revealed a clear preference among market gardeners for cow dung and poultry manure, with particularly high adoption rates. On the other hand, they highlighted a low use of compost. In the localities of Cocody, Koko, Téguéré and Logokaha, all the market gardeners surveyed (100%) indicated that they used cow dung exclusively as organic fertilizer. In Haoussabougou and Kassirimé, the rates were slightly lower, but remained very high, reaching 83.3% and 86% respectively.

Regarding poultry manure, the results highlighted a high adoption, particularly in Kassirimé and Téguéré, where all the market gardeners surveyed (100%) reported using it. The other areas also recorded high rates, varying between 88% and 96.5%. Conversely, compost is very little used. No market gardener uses it in Cocody, Haoussabougou and Téguéré. In Koko, Kassirimé and Logokaha, its use remained moderate, with respective rates of 16.7%, 12% and 18%. This analysis thus confirms that cow dung and poultry manure are the main sources of organic fertilizers used by market gardeners in the areas studied.

*Table 3: Different types of organic fertilizers used by market gardeners*

| | Proportion (%) | | | | | |
|---|---|---|---|---|---|---|
| Organic fertilizers | CCDY | HSBG | KOKO | KSME | TGRE | LGKA |
| Cow dung | 100 | 83.3 | 100 | 86 | 100 | 100 |
| Compost | 0 | 0 | 16.7 | 12 | 0 | 18 |
| Chicken droppings | 96.5 | 91.7 | 88 | 100 | 100 | 91.7 |

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**Methods of spreading organic fertilizers**

As part of the survey, the following three spreading methods were submitted to the market gardeners for their assessment: microdose, broadcast and lateral (Table 4). The results of the survey indicated that microdose spreading is the most widely adopted in the majority of localities. It is particularly dominant in Cocody and Téguéré, where it represents 75% of the practices recorded. In Koko and Kassirimé, this method also remained in the majority, with an identical rate of 58.3%. Even in the locality where it is least used, Haoussabougou, it still reaches 16.7%. Broadcast spreading, for its part, presents a marked variability depending on the locality. It is in the majority in Haoussabougou (83.3%), thus constituting an exception compared to other areas where microdose predominates. In Koko (41.7%) and Kassirimé (41.5%), this method occupies an important place, representing almost half of the practices observed, although it is overtaken by microdose spreading. In Cocody and Téguéré, it remains less frequent (25%), while in Logokaha, its use is equivalent to that of microdose, suggesting a balanced distribution between the two methods. No occurrence of lateral spreading was recorded in the areas surveyed (0%).

*Table 4: Different methods of spreading organic fertilizers by market gardeners*

| | Proportion (%) | | | | | |
|---|---|---|---|---|---|---|
| Spreading methods | CCDY | HSBG | KOKO | KSME | TGRE | LGKA |
| By volley | 25 | 83.3 | 41.7 | 41.5 | 25 | 50 |
| By microdose | 75 | 16.7 | 58.3 | 58.3 | 75 | 50 |
| Lateral | 0 | 0 | 0 | 0 | 0 | 0 |

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**Periods of application of organic fertilizers**

The study showed that organic fertilizers are generally applied to market garden crops one to two weeks before transplanting (Table 5). Analysis of the results indicated that the majority of market gardeners apply fertilizers one week before transplanting (01 SAVR), in all the areas studied. The proportions associated with this period vary from 66.7% in Kassirimé to 91.7% in Koko, Téguéré and Logokaha. On the other hand, application two weeks before transplanting (02 SAVR) is infrequent, or even absent in several areas. It is completely non-existent (0%) in Cocody, Koko, Kassirimé and Téguéré. It appears only marginally in Haoussabougou (8.3%) and reaches its highest level in Logokaha (17.7%). However, even in this latter locality, the practice of contribution to 01 SAVR remains very largely in the majority (91.7%), relegating 02 SAVR to a residual position.

*Table 5: Period of application of organic fertilizers*

| | Proportion (%) | | | | | |
|---|---|---|---|---|---|---|
| Periods | CCDY | HSBG | KOKO | KSME | TGRE | LGKA |
| 01 SAVR | 83.3 | 75 | 91.7 | 66.7 | 91.7 | 91.7 |
| 02 SAVR | 0 | 8.3 | 0 | 0 | 0 | 17.7 |

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha; 01 AVR: one week before transplanting; 02 SAVR: two weeks before transplanting

**Quantities of organic fertilizers used by producers**

The quantities of organic fertilizers applied by market gardeners vary according to the sites, with three main doses identified, namely 200 g, 300 g and 400 g per plant (Figure 6). Analysis of the results showed a clear predominance of the dose of 400 g/plant, widely adopted in most of the localities surveyed. It is used by 100% of producers in Cocody and Haoussabougou, by 91.7% in Koko, 83.3% in Kassirimé and 75% in Logokaha. On the other hand, doses of 200 g and 300 g/plant are rarely used. The dose of 200 g/plant was only observed in locality of Téguéré, where it reached 83.3%, while the dose of 300 g/plant was recorded only in Koko, with a rate of 16.7%. These results highlight a strong preference among producers for using 400 g/plant as a reference dose for the application of organic fertilizers under vegetable crops.

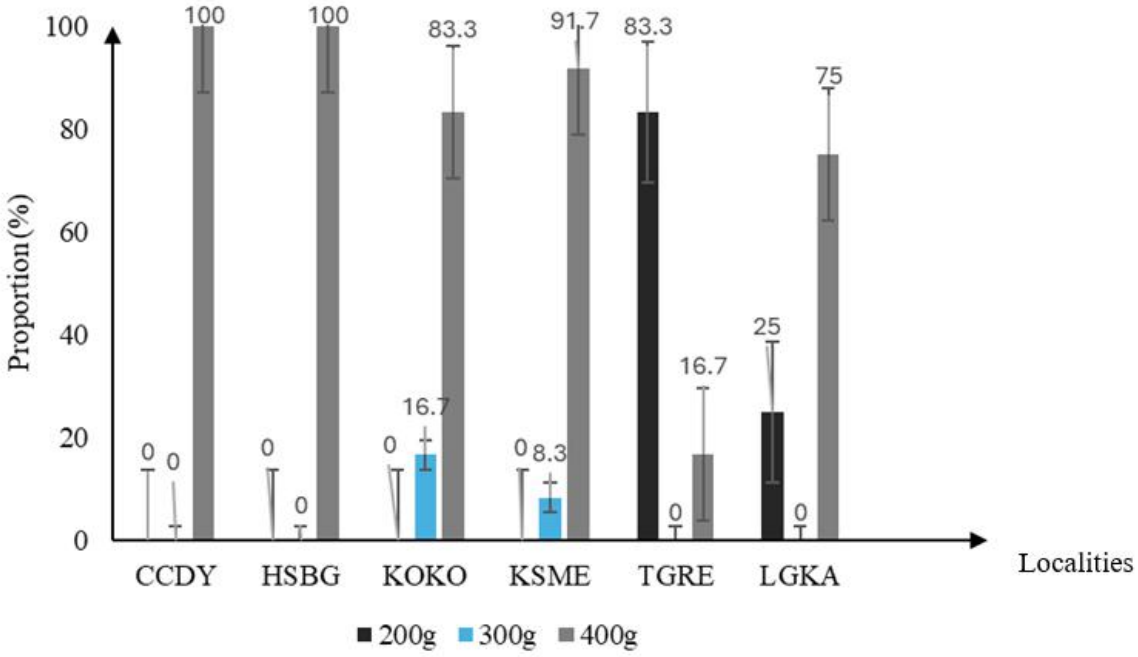


*Fig.6: Quantities of organic fertilizers provided by market gardeners*

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

**Constraints encountered by market gardeners**

The survey carried out in the six localities concerned made it possible to identify the main difficulties encountered by market gardeners, namely poor soils, lack of rain and crop destruction (Figure 7). Analysis of the responses showed that poor soils are the most frequently mentioned constraint, with a citation rate of 100% in Cocody, 97% in Haoussabougou, Kassirimé and Logokaha, and 94.6% in Téguéré. Although slightly lower, the proportion observed in Koko remained high, reaching 88.4%. Lack of rain is the second most mentioned constraint, but with more variable citation levels depending on the locality. It is particularly high in Cocody (93%), Haoussabougou (83.3%), Koko (83.3%) and Kassirimé (83.3%). In Téguéré, its proportion is 78% and in Logokaha, it reaches 91.7%. The least frequently mentioned constraint was the destruction of crops. It was cited by 93% of producers in Cocody, 87% in Haoussabougou, 75% in Koko and Kassirimé, 66.7% in Logokaha, and only 65% in Téguéré.

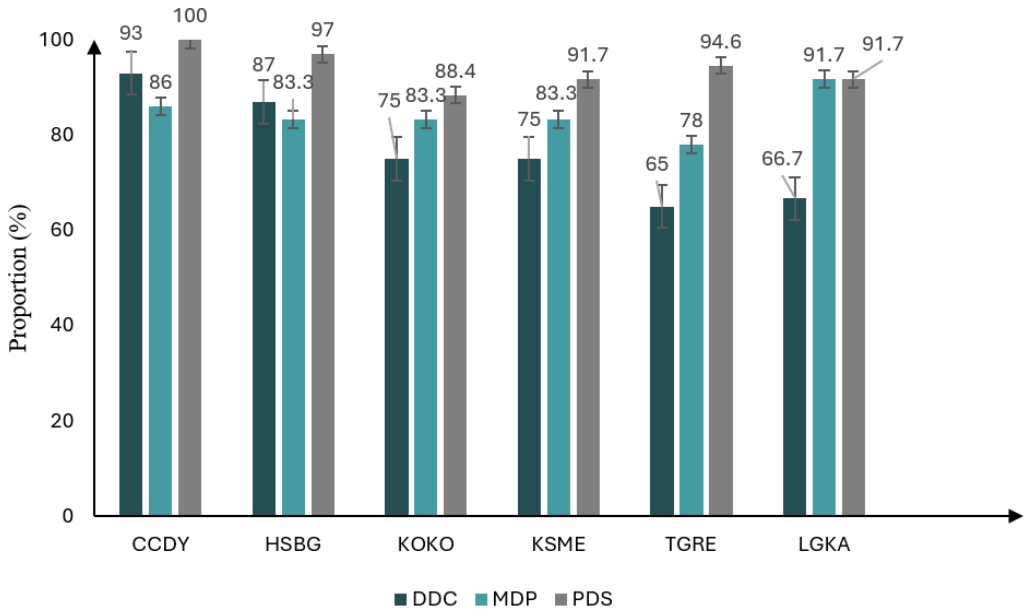


*Fig.7: Evaluation of constraints encountered by market gardeners depending on the location*

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha; DDC: Destruction of crops; MDP: Lack of rain; PDS: Soil poverty

**Market gardeners' perceptions of the use of compost from mango residues**

Market gardeners' perception of the use of compost from mango waste, as well as their ability to use it, is expressed as a percentage (%) in Table 6. Analysis of the results indicated that none of the market gardeners surveyed, regardless of location, currently uses this type of compost. However, all those surveyed reported being able to use it. This situation revealed a general lack of information on the possibilities of recovering mango waste through composting, although producers expressed a favorable disposition to its use.

*Table 6: Peasant perception of market gardeners on the use of compost from mango residues*

| | | Proportion (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | Perception | CCDY | HSBG | KOKO | KSME | TGRE | LGKA |
| Use | YES | 0 | 0 | 0 | 0 | 0 | 0 |
| | NO | 100 | 100 | 100 | 100 | 100 | 100 |
| Fit for use | YES | 100 | 100 | 100 | 100 | 100 | 100 |
| | NO | 0 | 0 | 0 | 0 | 0 | 0 |

CCDY: Cocody; HSBG: Haoussabougou; Koko; KSME: Kassirimé; TGRE: Téguéré; LGKA: Logokaha

## IV. DISCUSSION

An analysis of agricultural practices in Korhogo revealed a strong preference among market gardeners for chemical fertilizers when fertilizing their various crops. The survey results showed that approximately 60% of market gardeners used chemical fertilizers, compared to less than 30% for organic fertilizers. These results could be explained by the widespread availability of chemical fertilizers on local markets, their ease of use, and their immediate effect on crop growth and yields. This observed trend is consistent with those of [11] and [12], who pointed out that the intensive use of mineral fertilizers by producers is motivated by the search for rapid and high yields. Indeed, organic fertilizers are mainly underused due to their limited availability, lack of practical knowledge among producers, slow release of their nutrients and the large quantities required to achieve the desired effects. These causes were also supported by [13] and [14]. These authors indicated that a lack of awareness about organic fertilizers leads to their reduced use and a lack of knowledge about their real

effectiveness. Thus, the use of chemical fertilizers seems to be the priority, due to their immediate effects, while organic fertilizers are very little used, for many reasons.

In order to optimize fertilizer use, market gardeners have generally adopted the application of fertilizers by pocket, localized application, or microdose. Lateral and broadcast applications are only used irregularly in different areas. These results are justified by the fact that microdose applications are more economical, due to the reduction of nutrient losses and the high availability of these fertilizers for the benefit of the root system. This shows that producers choose the fertilizer application methods best suited to their limited resources and different types of crops. These results corroborate those of several studies conducted in sub-Saharan Africa. The work, conducted by [15] Fatondji *et al.* (2024), showed that microdose applications could improve fertilizer use efficiency by 40 to 50% compared to broadcast spreading. Similarly, studies by [16], in Senegal, and [17] in Ethiopia also showed that micro-dose fertilizer application could achieve higher yields than conventional broadcast and band application methods. This application method would reduce application quantities and investment costs, and improve fertilizer profitability and efficiency, particularly for smallholder farmers with limited resources.

NPK has been widely recognized as the most widely used chemical fertilizer in agriculture, due to its ability to improve soil fertility and boost yields. Studies, such as those by [18], from [19] and [20], confirm its effectiveness in various agro-ecological contexts. For these authors, the application of 100% NPK, in certain contexts, generates higher yields than those obtained with partial or combined dosages. The majority of the market gardeners surveyed apply chemical fertilizers two weeks after transplanting their market garden, because this method would be encouraged by research and agricultural cooperatives to improve fertilization efficiency and optimize crop production. These results corroborate those of [21], who showed that the application of nitrogen fertilizers, just before transplanting, optimizes their absorption, and limits losses. The effectiveness of fertilizers varied depending on the dose applied and the varieties grown. The dose of 40 g of NPK per plant was the most frequently mentioned. This dose was considered the most effective in this low fertility area. The mineral elements made available to crops were the most sufficient to cover their nutrient needs, in order to ensure good production. Works, like those of [22], showed that moderate doses of NPK, around 30 to 40 g per plant, and by localized application, improve the effectiveness of the fertilizer, in areas with low fertility, and the productivity of rice. Regarding the frequency of application, market gardeners mainly practiced split applications in two times per cycle. Split applications of mineral fertilizers, by the majority of market gardeners, would be justified by the coverage of nutrient needs at any time during the cycle of the crops grown. These results were confirmed by the work of [7]. These authors showed that for better optimization of the fertilizers to be applied, market gardeners adjust both the number of applications and the fertilizer doses according to the type of soil and the recommendations received. Therefore, for better crop productivity and a reduction in fertilizer losses, the doses, number of applications and timing of fertilizer use are rules to be respected within the framework of rational fertilization.

The survey also revealed that market gardeners largely prefer to use organic fertilizers of animal origin, such as cow dung and poultry droppings, to the detriment of composts from plant materials. This preference could be explained by the easy access to the droppings of these animals, which is due to the predominance of livestock farming in the survey region and the ease of decomposition or composting of animal organic matter . These results are supported by the work of [23] who showed that producers use a wide variety of animal manures for the amendment of different crops , due to their accessibility , high fertilizing value , immediate effect and ease of use . Similarly, [24] indicated that animal droppings are a high source of major and secondary mineral elements, namely, N, P, K, Ca, Mg and Cl.

The study also showed that the market gardeners surveyed mostly apply compost a week before transplanting the seedlings. This practice can be explained by the fact that the organic matter has already been mineralized, and its nutrients will be immediately usable when the plants are installed. In the same vein, [25] showed that organic fertilizers with a low C/N ratio released nutrients quickly, making them easier for farmers to use. According to [26], market gardeners in northern Côte d'Ivoire adopt empirical soil fertility management practices based on personal experience. Indeed, according to these authors, the addition of organic fertilizers, some time before planting crops, is considered an effective and reassuring compromise for producers.

Our results showed that most of the market gardeners surveyed used a dose of 400 g of organic fertilizer per plant, while doses of 200 and 300 g were not very widespread. This preference for high doses could be explained by farmers' concern to provide a sufficient quantity of nutrients to crops, in the absence of soil analyses. [27], [28] and [29] highlighted the positive effects of high organic fertilizer application under vegetable crops in different growing regions. These high inputs of organic fertilizers contribute

not only to improving crop yields and the quality of production, but also to sustainably improving the physicochemical properties of the soil.

The survey indicated that the main constraint for market gardeners is soil depletion, aggravated by a rainfall deficit. This situation is said to be the result of land pressure, which is very imminent and recurrent in the northern regions of the country. This soil depletion is also due to overexploitation of arable land, uncontrolled urbanization, prolonged use of chemical fertilizers and inadequate cultivation practices [30], [31].

None of the producers surveyed uses compost from mango waste. This situation could be explained by several reasons, namely, the lack of information on the use of mango residues for composting, the difficulty of mineralizing mango waste, the lack of information on the chemical and mineral compositions of mango residues by producers and the difficulty of acquiring mango waste. For some authors, the limited adoption of mango residues, as organic fertilizer, is explained by a lack of technical training of producers in composting and equipment adapted to composting and the failure to restructure the sector to assess losses [32], [33]. Indeed, huge quantities of mangoes are lost by the sector and huge waste is rejected each year by processing units, but also by the majority of producers and retailers [33]. In a context of transition towards more sustainable agricultural practices, composting mango residues would represent a local and economic solution for producers, the sector and, above all, for market gardeners.

## V. CONCLUSION

The study, conducted in Korhogo, made it possible to take stock of the fertilization practices used by market gardeners, while evaluating the prospects for introducing compost from mango residues, as a local and sustainable solution.The results revealed a heavy reliance on chemical fertilizers, especially NPK, for its availability and immediate effectiveness. Organic fertilizers remain underused, often due to their slower effect, and compost is largely unknown. Microdosing is the most common application method. It allows for optimal fertilizer use, limiting leaching losses, while ensuring good yields. During the survey, market gardeners also highlighted several major constraints affecting their activity and the sustainability of production systems. These are soil depletion, climate variability, pest pressure, and a lack of technical support. Despite these challenges, discussions showed a growing interest in mango compost, particularly because these residues are locally available in large quantities in the city of Korhogo. However, its adoption remains limited, hampered by a lack of information on its use as organic matter for composting. Thus, future research is needed to develop a composting process accessible to all, in order to facilitate its integration into market gardeners' agricultural practices. This approach will help restore soil fertility, contribute to reducing dependence on chemical fertilizers and consolidate the resilience of market gardening systems.

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