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SOCIO-ECONOMIC AND ENVIRONMENTAL ANALYSIS OF ORGANIC MARKET GARDENING OF CERTIFIED BIO PARTICIPATORY GUARANTEE SYSTEM IN THE PROVINCE OF KADIOGO IN BURKINA FASO

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ABSTRACT

Conventional gardening leads to major negative effects such as soil degradation, water pollution, biodiversity loss, and health risks for the population. Face to those challenges, organic vegetable farming certified by the Participatory Guarantee System (Bio-PGS) is emerging as a sustainable alternative. This study explores its socio-economic and environmental impacts in urban, peri-urban, and rural areas of the Kadiogo province of Burkina Faso. Data was collected by survey from 20 key informants and 102 Bio-PGS producers. Descriptive analysis and statistical tests (Chi-Square and Fisher) has been applied. In peri-urban, rural, and urban areas, women represent 100%, 76.47%, and 96.83% of producers, respectively. Yields declining, high cost of chemical inputs, and distribution network encourage producers to adopt market gardening of certified bio participatory guarantee system. For biopesticides *chili pepper*, *garlic*, and *papaya* leaf mixture was the most commonly used in urban (60%), rural (12%) and peri urban (19%) areas. As for bio-fertilizers compost (63%) were mostly used in urban areas, *Bokassi* and compost (17%) in rural areas and *Bokassi* (21%) in peri-urban areas. Resource-saving practices were reported by 100% of producers in peri-urban areas, 94.12% in rural areas and 46.03% in urban areas. There was a significant difference at the 1% level between peri-urban and urban areas ($p < 0.0001$) and between rural and urban areas ($p = 0.0014$). Intercropping was practiced by all farmers in peri-urban areas, 30.77% in rural areas and 63.41% in urban areas. There was a significant difference between the proportions in peri-urban and rural areas ($p < 0.0001$) and between peri-urban and urban areas ($p = 0.0015$). Repellant plants were used by 22.77% of producers in peri-urban areas, 100% in rural areas and 78.05% in urban areas. There was a significant difference at the 1% level between the proportions in peri-urban and rural areas ($p = 0.0003$) and between peri-urban and urban areas ($p = 0.0116$). Individual producers (98.89%), producers with market access (66.67%), of producers who are members of an association (100%) and *Amaranthus* producers (96.47%) had an income between 0 and 500,000 CFA francs, with a significant difference compared to those with an income above 500,000 CFA francs. For maximizing Bio-PGS potential, additional efforts are needed, particularly in terms of institutional support and consumer awareness.

Key words: Bio-PGS certification, Burkina Faso, Incomes, Vegetable farming, Sustainability

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INTRODUCTION

In sub-Saharan Africa, agriculture occupies a predominant place, contributing around 15% of the Gross Domestic Product (GDP) and ensuring the livelihoods of millions of people [1]. In Burkina Faso, this sector represents more than 30% of GDP and employs 80% of the active population [2]. Among the various agricultural sectors, market gardening has been developed strongly through to the Accelerated Growth and Sustainable Development Strategy and the National Economic and Social Development Plan [3]. Market gardening is a dynamic activity that meets a strong demand for food, particularly in urban areas [4].

In rural areas, it plays a key role in agricultural diversification, economic growth, and the reduction of poverty and malnutrition [5, 6]. In 2021, this sector generated 220.4 billion CFA francs in revenue and employed approximately 400,000 people [5]. However, the sustainability of market gardening is undermined by the degradation of natural resources, aggravated by intensive farming practices, climate change, and demographic pressure [6]. The excessive use of synthetic inputs, often motivated by the pursuit of high yields, has adverse effects on the environment, human, and animal health [7, 8]. These threats, combined with food risks from pesticide residues, highlight the urgency of exploring more sustainable alternatives [9].

Faced with these challenges, organic agriculture appears to be a promising solution. Among the emerging models, organic market gardening certified by the Participatory Guarantee System (Bio-PGS) stands out as an innovative approach aimed at reconciling food security, environmental preservation, and boosting the local economy, particularly in the Kadiogo province [10]. It was born from the desire to promote fair organic agriculture that is accessible to producers with low incomes and recognized by consumers. It is based on participatory certification involving producers, consumers, and other local stakeholders, founded on principles of trust, fairness, and transparency. It fosters a community-based and accessible approach, particularly suited to small-scale producers in Burkina Faso [11]. The participatory guarantee system certification process includes several key steps: producer engagement, training and awareness-raising, participatory visits, documentation and transparency, certification, and reassessment [12, 13]. This participatory production model fosters a relationship of trust between producers and consumers, while reducing certification costs. Furthermore, it encourages continuous improvement of agricultural practices through the ongoing sharing of knowledge and experience within the community [13, 14]. The bio participatory guarantee system contributes to environmental preservation, strengthens the resilience of farmers, facilitates access to niche markets, increases consumer confidence, and stimulates demand for organic products [15].



Developed in the 1970s in Brazil and India, Bio-PGS was officially recognized by the International Federation of Organic Agriculture Movements (IFOAM) in 2004 as a credible alternative to traditional organic certifications. Since then, it has been adapted to various contexts around the world. In Burkina Faso, the National Council for Organic Agriculture (CNABio) introduced it in 2015 to promote organic agriculture accessible to small producers and women, particularly in urban and peri-urban areas [11, 16].

According to CNABio, Bio-PGS is experiencing significant growth today with 1,235 certified producers, 83% of whom are women, cultivating 316 hectares [17]. The same source indicates that the distribution of organic PGS products is mainly based on direct sales via farms, markets, as well as certain specialized stores and supermarkets. However, several challenges hinder its expansion: lack of organizational structure, lack of awareness of certification labels, and difficulties in product distribution. Another major obstacle lies in the lack of scientific data to rigorously assess the impact of Bio-PGS. This deficiency limits the adoption of appropriate policies and support for producers in their agro-ecological transition [11]. Although the demand for organic products is growing, what are the real effects of Bio-PGS on the economic conditions of producers and on the sustainability of farms?

It is in this context that this study was undertaken in order to deepen the understanding of the socio-economic and environmental effects of organic market gardening certified Bio-PGS and to provide evidence to guide decision-making in favor of more sustainable and inclusive agricultural development in Burkina Faso. Specifically, it involved (i) characterizing the sustainable practices adopted by producers certified Bio-PGS (ii) analyzing the factors potentially influencing the income of organic market gardening certified Bio-PGS.

MATERIALS AND METHODS

Materials

Study area

The Kadiogo province, located in the center of Burkina Faso, was chosen due to the development of urban and peri-urban agriculture, particularly market gardening. This choice was also justified by the presence of a greater number of Bio-PGS certified sites in the province [17]. Indeed, out of a total area of 30,250 hectares of market garden crops sown in the Kadiogo province, 210 hectares were certified Bio-PGS [17, 18].

Kadiogo is composed of six departments, namely Komki-Ipala, Koubri, Komsilga, Pabré, Saaba and Tanghin-Dassouri and Ouagadougou [2] (**Error! Reference source not found.**). It consists mainly of a peneplain with altitudes varying between



300 and 400 meters, while the valleys and lowlands reach around 200 meters above sea level [2]. Several soil types are identified in the Kadiogo province: 59.7% hardened leached tropical ferruginous soils, 33% lowland hydromorphic soils and 7.3% poorly evolved soils [2, 19, 20]. Participatory Guarantee System certified producers is largely based on adapting soils to environmentally friendly agricultural techniques. Kadiogo province, with a population of over 3 million 60% of whom are under 25 years old [2]. Their main activities are agriculture, livestock farming, trade, and crafts.

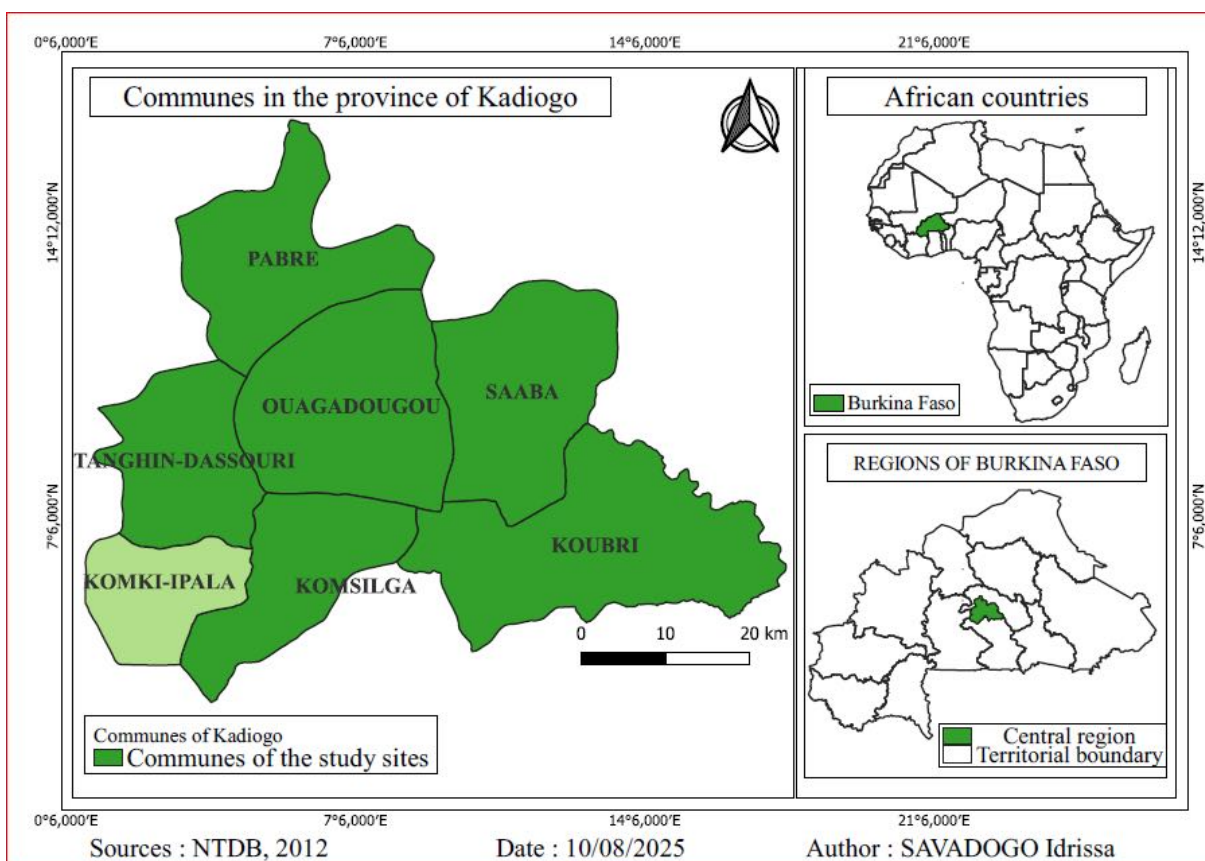


Figure 1: Study area map

Data collection tools

A household survey questionnaire and an interview guide were used for data collection. The guide provided information on perceptions of the actors, the constraints the social dynamics generated by the Bio-PGS label while the questionnaire provided information on the household socio-demographic characteristics, effects of Bio-PGS on environmental preservation, yields, income, job creation, quality of life, constraints cultural practices of producers adhering to the Bio-PGS label, environmental preservation practices and income. The questionnaire was digitized on Kobo Toolbox.

Methods

Sampling

Choosing survey sites

The survey took place in urban, peri-urban and rural environments of six municipalities in Kadiogo province. The urban environment refers to densely populated and built-up areas of human habitation, such as cities and urban areas, characterized by a high concentration of population and buildings. A peri-urban environment is an area on the outskirts of large cities, characterized by a low population density, a mix of single-family homes and rural areas, and a strong dependence on urban employment. The rural environment is often defined in contrast to the city, as an area of low population density, marked by predominantly agricultural landscapes and an economy more closely linked to the primary sector [21].

Each site was chosen based on its specific characteristics, namely:

- Urban area: (Municipality of Ouagadougou): Surveys were conducted at all urban sites certified as Organic PGS. These urban sites are predominantly women-owned. The areas are between 10 m² to 300 m², but a wide variety of crops are cultivated, especially those with short production cycles. These sites maintain year-round production.
- Peri-urban sites (Gampela and Komsilga): peri-urban sites with a dynamic market gardening sector. The areas are 10 m² to 300 m². These sites are cultivated in the off-season.
- Rural area (Tanghin Dassouri, Pabre and Koubri): These sites are predominantly private small holdings with approximately 1 hectare.

The study covered all market gardeners and resource persons involved in Bio-PGS certified market gardening production.

Choice of key persons

Twenty key persons from non-governmental organizations and CNABio member associations, as well as some leading producers were chosen using the snowball method (the first interviewer proposed a list of 3 people from which one will be investigated, the latter also proposes a list of three people and so on). They were interviewed until no new information emerged (point of saturation). The selection of these resource people was made in a reasoned manner according to the following criteria:

- have at least three years of experience in PGS certified organic production;
- be an active member of the PGS organic label



Choice of households surveyed

A representative sample was determined based on the following statistical formula. It offers a 5% level of precision and a 95% level of confidence.

$$n = \left[\frac{[tp]^2 \times p(1-p) \times N}{[tp]^2 \times p(1-p) + (N-1) \times y^2} \right]$$

with:

n = sample size

N = size of targeted population

P = expected proportion of a response or actual proportion, set to 0.5 by default

tp = sampling confidence interval

Y = margin of sampling error

From this formula, a list of 120 certified producers was selected. Of this list, 102 producers were interviewed. The main selection criteria were availability, compliance with the PGS organic farming standards, and up-to-date membership fees.

Data collection and analysis

Data collection combined a qualitative and a quantitative approach. Qualitative data were collected using the interview guide administered face-to-face to resource persons from February to October 2023. The questionnaire was administered face-to-face to Bio-PGS certified producers to collect quantitative data. The data was collected in the local language, Moore.

For data analysis Chi-Square test was applied to compare variables using Stata 16.0 software.

RESULTS AND DISCUSSION

Socio-economic characteristics and motivations of participatory guarantee system certified bio producers

Table 1 presents the socio-economic characteristics of producers and their motivations for practicing Bio-PGS. In peri-urban, rural, and urban areas, women represented 100%, 76.47%, and 96.83%, respectively. A significant difference was observed between the proportion of women in peri-urban and rural areas at the 10% threshold (p-value = 0.0172) and between rural and urban areas at the 1% threshold (p-value = 0.007). Men were the majority in rural areas (25.53%), followed by urban areas (3.17%). This result could be explained by land constraints and the smallness Bio-PGS areas cultivated. Women play a key role in urban agriculture and direct sales in local markets, while men are more active on larger farms in rural areas [22, 23]. Producers with small plots often adopt specific practices to maximize the profitability of small areas [24].



Participatory Guarantee System (PGS) organic producers were primarily individual producers. Individual producers represented 95.5% in peri-urban areas, 64.71% in rural areas, and 96.83% in urban areas. There was a significant difference in proportion between peri-urban and rural areas ($p = 0.0211$) at the 5% level, and between rural and urban areas ($p = 0.0003$) at the 1% level. This could be explained by the fact that rural farms generally have larger areas of land, while urban and peri-urban producers often work on small plots, leading them to operate individually. The diversity reflects the involvement of various actors in PGS, including individual producers on small plots, people undergoing career transitions or retired, and predominantly female groups, particularly numerous in urban and peri-urban areas of Ouagadougou, the capital of Kadiogo [16].

The main reasons that influenced producers to choose organic market gardening vary by region. These included declining yields, the high cost of chemical inputs, and the marketing distribution network. The proportion of producers citing declining yields was 54.54% in peri-urban areas, 100% in rural areas, and 87.3% in urban areas. There was a significant difference at the 1% level between the proportions in peri-urban and rural areas ($p = 0.001$) and between peri-urban and urban areas ($p = 0.001$).

Regarding the high cost of inputs, the proportions were 100% in peri-urban areas, 63.64% in rural areas, and 80.95% in urban areas. These proportions were significantly different at the 5% level between peri-urban and rural areas ($p = 0.033$) and between rural and urban areas ($p = 0.033$). For health concerns, the difference was significant at the 1% level between peri-urban areas (72.73%) and rural areas (100%) ($p = 0.033$). The motivations for adopting organic practices vary according to local constraints, such as proximity to niche markets in urban areas and environmental health concerns in densely populated areas [16]. The impact of organic practices in health domain was recognized [25].

The impact of organic market gardening on producers' living standards varied considerably across the areas studied. In peri-urban areas, 95.45% of producers believed their living standards had significantly improved thanks to organic farming, compared to 29.41% in rural areas and 53.97% in urban areas. A significant difference at the 1% level was observed between the proportions in peri-urban and rural areas ($p = 0.0004$) and between peri-urban and urban areas ($p = 0.0011$). This result can be explained by the proximity of urban markets, which allows peri-urban and urban producers to better market their organic products and obtain a more stable income by taking advantage of these markets.

Analysis of producers' incomes confirmed this trend. More than 60% of the producers surveyed had an income between 0 and 500,000 CFA francs. This



proportion was 100% in peri-urban areas, 64.7% in rural areas, and 90.48% in urban areas. There was a significant difference at the 1% level between peri-urban and rural areas ($p = 0.0030$), at the 10% level between peri-urban and urban areas ($p = 0.1337$), and at the 5% level between rural and urban areas ($p = 0.0228$). This finding can be explained by the fact that rural producers generally had larger land areas and easier access to natural resources, thus allowing them to operate their activities on a larger scale.

Crops produced under bio participatory guarantee system

Lactuca sativa L. and *Amaranthus* were the most produced crops in urban areas 63% and 57%, respectively, Figure 2. *Rumex* was also widely grown, particularly on urban farms (29%), while *Daucus carota*, *Brassica oleracea* and *Spinacia oleracea* were moderately produced, especially in urban areas (24%, 22% and 15% respectively). The predominance *Lactuca sativa L.* and *Amaranthus* in urban areas showed an adaptation to short cycles and the strong local demand for fresh vegetables. These crops allowed producers to respond quickly to consumer needs [26].

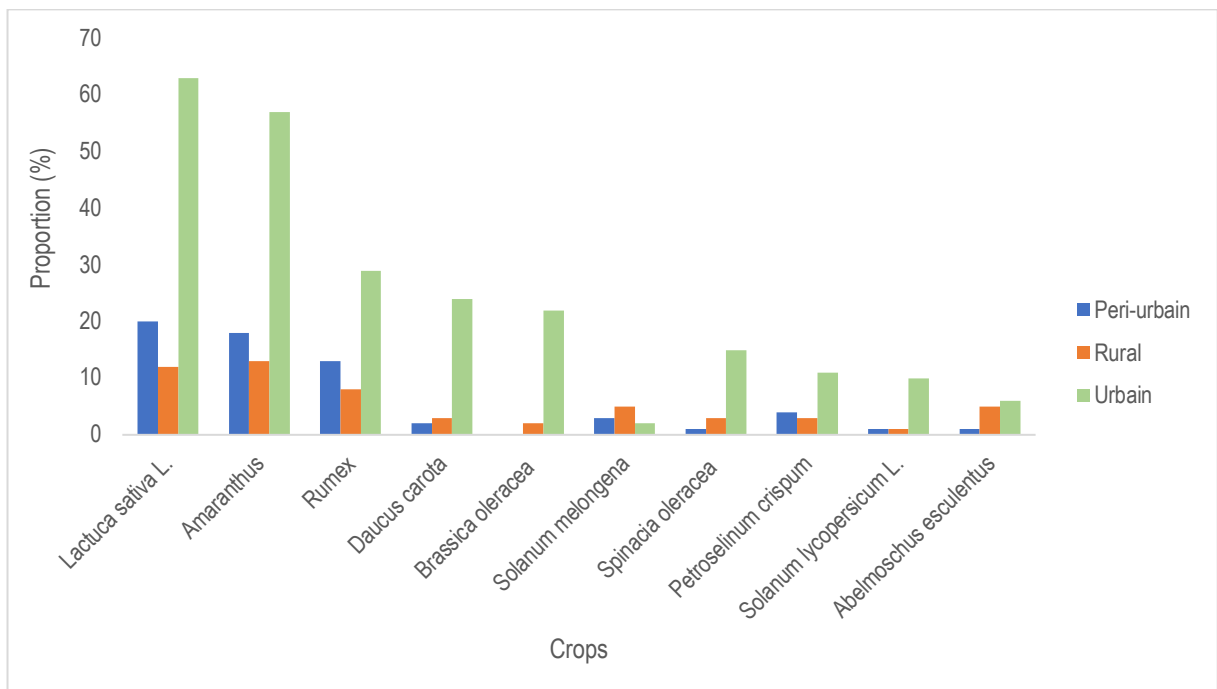


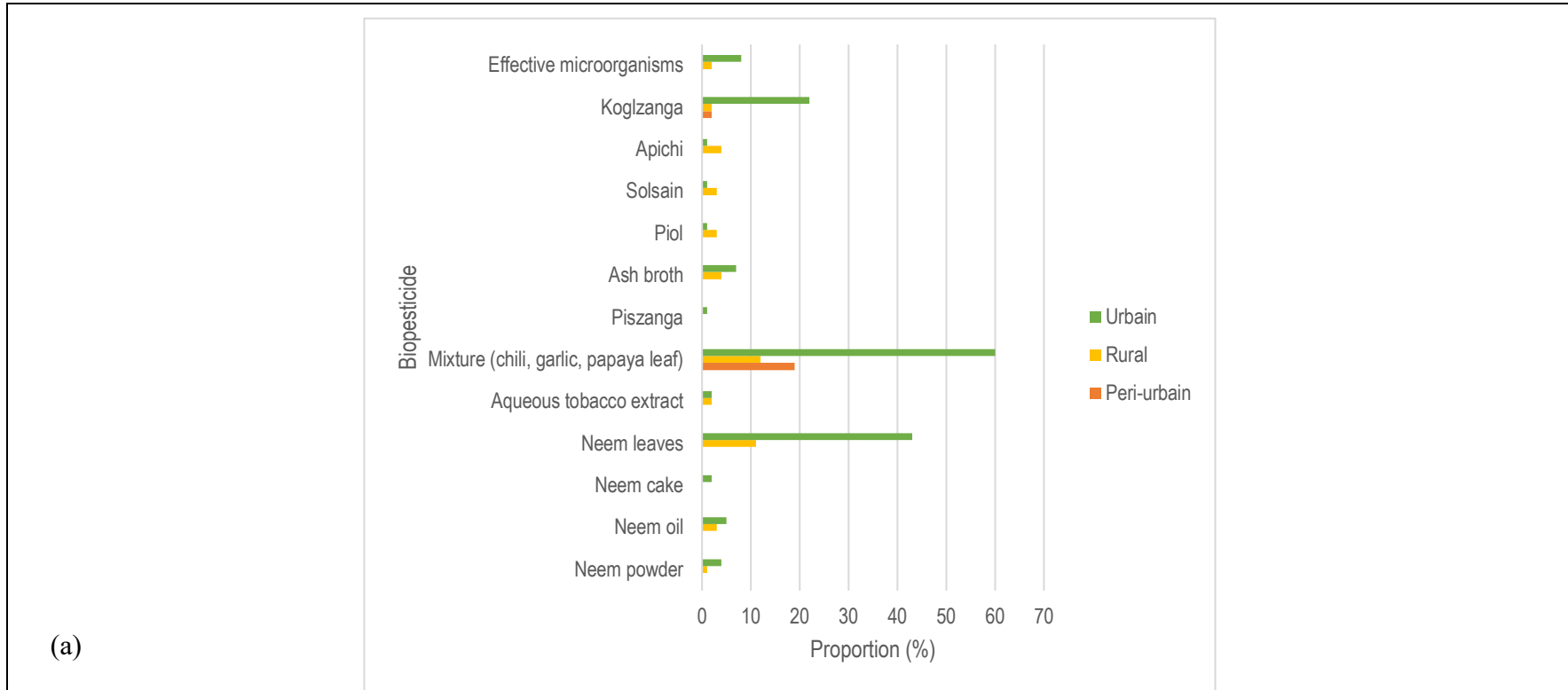
Figure 2: Crops produced certified Bio-PGS, n = 102

Bio-inputs used by producers

For biopesticides (Figure 3a), chili pepper, garlic, and *papaya* leaf mixture were the most commonly used, with a frequency of 60% in urban and peri-urban areas. Neem leaves, used in 43% of cases, also played an important role in urban areas. The

biopesticide known locally as "*Kogzanga*" was composed of chili pepper or black pepper, garlic, ginger, and neem oil. It was used by 22% of producers in urban areas. As for biofertilizers (*Figure 3b*), compost was the most used in urban areas (63%), and a notable presence in rural (17%) and peri-urban (15%) areas. Organic manure was mainly used in urban areas (20%). However, its use remained more limited in peri-urban (10%) and rural (3%) areas. Similarly, *Bokashi* was a commonly used input in urban areas (60%), but it nevertheless remained present in peri-urban (21%) and rural (17%) areas. The adoption of bio-inputs responded to environmental and economic concerns. They promoted soil resilience face to climate change [19]. Their use maintained ecological balance in organic production systems, and was aligned with the sustainability and ecosystem preservation objectives supported by the Bio-PGS certification. Biofertilizers improves soil fertility, enriches microfauna, and increases water retention, which is essential in semi-arid contexts such as that of Burkina Faso [27].





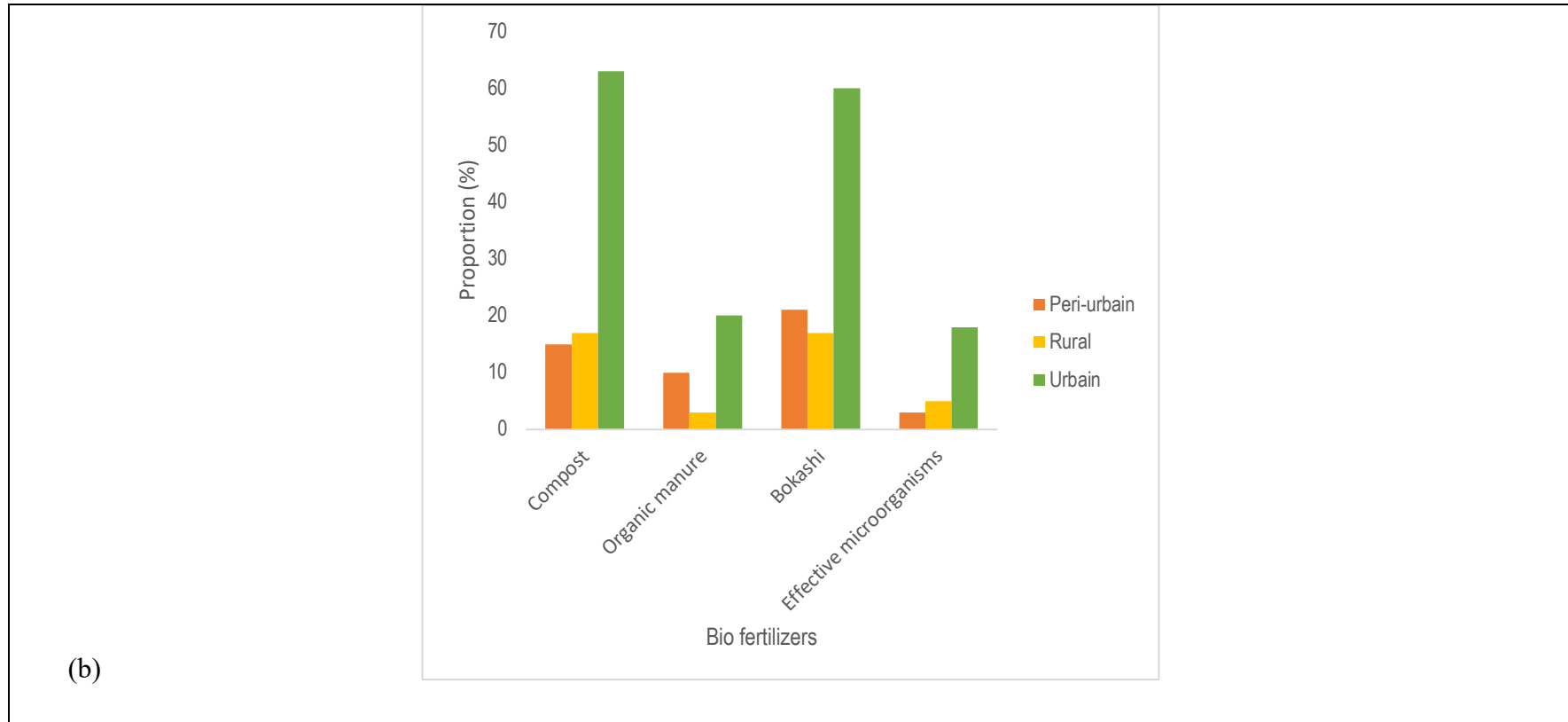


Figure 3: Biopesticides (a) and biofertilizers (b) used, n= 102

Sustainable practices adopted by bio participatory guarantee system certified producers

Table 2 presents the main environmental preservation practices applied by certified bio participatory guarantee system producers. Resource-saving practices were reported by 100% of producers in peri-urban areas, 94.12% in rural areas, and 46.03% in urban areas. There was a significant difference at the 1% level between peri-urban and urban areas ($p < 0.0001$) and between rural and urban areas ($p = 0.0014$). Compost was used by 68.18% of producers in peri-urban areas and by 100% in both rural and urban areas. There was a significant difference at the 1% level between peri-urban and rural areas ($p = 0.0117$) and between peri-urban and urban areas ($p < 0.0001$). Intercropping was applied by 100% in peri-urban areas, 30.77% in rural areas and 63.41% in urban areas. There was a significant difference between the proportions in peri-urban and rural areas ($p < 0.0001$) and between peri-urban and urban areas ($p = 0.0015$). Repellent plants were used by 22.77% of producers in peri-urban areas, 100% in rural areas, and 78.05% in urban areas. There was a significant difference at the 1% level between the proportions in peri-urban and rural areas ($p = 0.0003$) and between peri-urban and urban areas ($p = 0.0116$).

These agroecological practices are part of a sustainable production framework adapted to the environmental conditions of the Kadiogo province [5, 16, 28, 29]. Practices such as agroforestry, crop rotation, water management, stone barriers, the use of organic manures, and soil conservation methods aim to restore agricultural ecosystems and protect natural resources while strengthening the resilience of production systems [28, 29]. These techniques allow producers to maintain stable agricultural yields despite climatic challenges [20, 30]. These practices have increased soil water retention capacity by 15% and reduced erosion by 20% in rural areas [5]. The combination of livestock and market gardening plays a vital role in improving soil fertility and the sustainability of production systems. Agriculture-livestock integration contributes to ecological intensification [31].

Factors determining income

Table 3 presents the variables influencing the income of bio participatory guarantee system producers. Individual producers (98.89%) had an income between 0 and 500,000 CFA francs, while 33.33% had more ($p < 0.001$). Producers selling at the market (66.67% had an income above 500,000 CFA francs, while 1.11% had an income between 0 and 500,000 CFA francs ($p < 0.001$). According to the labor source, 89.8% of those who work themselves had an income between 0 and 500,000 CFA francs, while 20% had more ($p = 0.0044$). Amaranthus producers (100%) had an income between 0 and 500,000 CFA francs, and 54.55% had more ($p = 0.0001$).



Bio-PGS certification allows women to access specific markets while offering them a more valued socio-economic status [16]. In short, organic market gardening certified by Bio-PGS has a direct impact on improving producers' incomes. According to data from the 2021 agro-sylvopastoral statistics yearbook, certified producers record an average turnover of 25% higher than that of conventional producers. This increase is attributed to the added value of organic products, often intended for niche markets [5].

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

This study highlighted the socio-economic and environmental impacts of organic market gardening certified by bio participatory guarantee system in urban, peri-urban, and rural areas of Kadiogo province. The sustainable practices adopted by bio participatory guarantee system certified producers contribute significantly to environmental preservation. Producers in urban areas benefit more from access to niche markets, with annual incomes of up to 10 000 000 CFA francs. In peri-urban and rural areas, incomes remain relatively lower, but still benefit from contract farming and the development of e-commerce. The emergence of consultation frameworks and participatory initiatives strengthens social cohesion among producers and the empowerment of women. Taking into account the diversity of stakeholders and their environment is a key factor in the success of bio participatory guarantee system certification programs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.



Table 1: Socio-economic profiles and motivations of bio participatory guarantee system producers

Variables	Living environment			p-value		
	Peri-urban (n = 22)	Rural (n = 17)	Urban (n = 63)	(1)	(2)	(3)
Sex (%)						
Women	100 ^a	76,47 ^b	96,83 ^a	0,0172*	0,3981	0,007***
Men	0	23,53 ^a	3,17 ^a	-	-	0,5289
Farm type (%)						
Collective farm	4,55 ^a	5,88 ^a	3,17 ^a	-	-	-
Private farm	0	29,41	0	-	-	-
Individual producer	95,5 ^a	64,71 ^b	96,83 ^a	0,0211**	0,7674	0,0003***
Reasons for adopting Bio PGS (%)						
Lower yields Yes	54,54 ^a	100 ^b	87,30 ^b	0,001***	0,001***	0,9939
High cost of chemical input Yes	100 ^a	63,64 ^a	80,95 ^a	0,033**	0,6167	0,033**
Preserve your health Yes	72,73 ^a	100 ^b	87,30 ^a	0,003**	0,4551	0,3751
Organic product distribution network (%)						
Yes	0	43,75 ^a	7,94 ^a	-	-	0,1770
Membership in an association						
Yes	100 ^{ab}	94,12 ^a	100 ^{ab}	0,2494	-	0,0528**
Improvement of living standards (%)						
Not really agree	4,55	0	0	-	-	-
Mostly agree	0	70,59 ^a	46,03 ^a	-	-	0,1516
Completely agree	95,45 ^a	29,41 ^b	53,97 ^b	0,0004***	0,0011***	0,3050
Income (F CFA)						
0 to 500 000	100 ^a	64,71 ^b	90,48 ^c	0,0030***	0,1337*	0,0228**
500,000 to 1000,000	0	0	4,76	-	-	-



1,000,000 to 1,500,000	0	0	1,59	-	-	-
1500 000 to 2000 000	0	5,88	0	-	-	-
2,000,000 to 10,000,000	0	23,53	0	-	-	-
10,000,000 to 20,000,000	0	5,88 ^a	3,17 ^a	-	-	-

Significance : *** = 1% ; ** = 5% ; * = 10 % ; - non applicable; n= number

The various letters on the same line indicate significant differences between the variables. The p-values are defined as follows: (1) compares peri-urban to rural, (2) compares peri-urban to urban, and (3) compares rural to urban

Table 2: Sustainable practices applied at survey sites

Variables (%)	Living environment			p-value		
	Peri-Urbain (n = 22)	Rural (n = 17)	Urbain (n = 63)	(1)	(2)	(3)
Tree planting						
Yes	95,45 ^a	100 ^a	98,41 ^a	0,3731	0,4379	0,6009
Construction of water reservoirs						
Yes	4,55 ^a	82,35 ^a	73,02 ^a	-	-	0,4791
Adoption of economical practices						
Yes	100 ^a	94,12 ^a	46,03 ^b	0,2494	<0,0001***	0,0014***
Use of renewable energy						
Yes	100 ^a	100 ^a	51,79 ^b	-	0,0001***	0,0006***
Organic fertilizers used						
Compost	68.18 ^a	100 ^b	100 ^b	0,0117***	<0,0001***	-
Organic manure	45,45 ^a	17,65 ^a	31,75 ^a	0,3867	0,4620	0,6189
Bokashi	95,45 ^a	100 ^a	95,24 ^a	0,3731	0,9688	0,3593
Effective microorganism	13,64 ^a	29,41 ^a	28,57 ^a	0,6105	0,5872	0,9707
Association of crops						



Yes	100 ^a	30,77 ^b	63,41 ^b	<0,0001***	0,0015***	0,2165
Intercropping						
Yes	59,09 ^a	15,38 ^a	51,22 ^a	0,2487	0,6544	0,3324
Repellent plants						
Yes	22,73 ^a	100 ^b	78,05 ^b	0,0003***	0,0116***	0,0659
Use of more resistant varieties						
Yes	0	20,77 ^a	7,32 ^a	-	-	0,4487
Agriculture-Livestock Association						
Yes	42,86 ^a	41,18 ^a	13,79 ^a	0,9462	0,1882	0,2309
Use of animal droppings						
Organic manure	88,89 ^a	57,14 ^a	50 ^a	0,2084	0,4942	0,5536
Compost	100	100	100	-	-	-
Use of crop residues						
Livestock feed	18,18 ^a	41,18 ^a	8,33 ^a	0,4345	0,6593	0,2089
Fallow	31,82 ^a	23,53 ^a	13,33 ^a	0,7702	0,3881	0,6554
Compost production	100	100	100	-	-	-
Biogas production	0	28,57 ^a	12,50 ^a	-	-	-

Significance : *** = 1% ; ** = 5% ; * = 10 % ; - non applicable ; n= number

The various letters on the same line indicate significant differences between the variables. The p-values are defined as follows: (1) compares peri-urban to rural, (2) compares peri-urban to urban, and (3) compares rural to urban



Table 3: Explanatory factors for the income level

Variables (%)	Income (annual turnover)		p-value
	0 – 500,000 (n = 90)	> 500,000 (n = 12)	
Living environment			
Peri-urban	24,44	0	-
Urban	12,22 ^a	50 ^a	0,0879
Rural	63,53 ^a	50 ^a	0,5221
Type of farm			
Collective farm	1,11 ^a	25 ^a	-
Individual private farm	0	41,67	-
Individual producer	98,89 ^a	33,33 ^b	< 0,001***
Education level			
Literate	8,89	0	-
None	52,22 ^a	33,33 ^a	0,4682
Koranic school	3,33	0	-
Primary	22,22	0	-
Secondary	13,33 ^a	33,33 ^a	0,3706
University	0	33,33	-
Existence of a market for organic producers			
Yes	1,11 ^a	66,67 ^b	< 0,001***
Association membership			
Yes	100 ^a	91,67 ^b	0,0059***
Type of labor			
Yourself	89,8 ^a	20 ^b	0,0044***
Family	10,20	0	-
Employee	0	50	-
Family + Employee	0	30	-
Crops produced			
Amaranthus	96,47 ^a	54,55 ^b	0,0001***
Rumex	52,94 ^a	45,45 ^a	0,7504
Daucus carota	26,67 ^a	41,67 ^a	0,5024
Brassica oleracea	22,22 ^a	33,33 ^a	0,6352
Solanum melongena	6,67 ^a	33,33 ^a	0,2752
Spinacia oleracea	16,67 ^a	33,33 ^a	0,4607
Petroselinum crispum	16,67 ^a	25 ^a	0,7321
Solanum lycopersicum L.	10 ^a	25 ^a	0,5135

Significance : *** = 1% ; ** = 5% ; * = 10 % ; - non applicable ; n= number

The various letters on the same line indicate significant differences between the variables. The p-values compare 0 – 500,000 to > 500,000



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