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PRODUCER KNOWLEDGE AND PERCEPTIONS OF HEALTH AND ENVIRONMENTAL RISKS RELATED TO URBAN AND PERI-URBAN AGRICULTURE ON WASTE DISPOSAL: THE CASE OF THE CITY OF BOBO-DIOULASSO (BURKINA FASO)

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ABSTRACT

The use of urban waste as fertilizer is dangerous for human health and the environment because of contamination of soil, water sources, plants and air by undesirable elements (heavy metals, toxic gases, pathogenic organism, etc.). The study was conducted at four garbage disposal sites in the city of Bobo-Dioulasso (Burkina Faso). The main objective of this study was to assess the knowledge and perceptions of producers about the health and environmental risks of using garbage disposal sites for agricultural production. The data was collected in a semi-structured interview with a site and producer interview guide. The results show that the majority of producers are married men with an age range between 47 and 57 years. Most have a very low level of education, with 36.36% out of school and 45.45% who have reached primary school. 100% of the respondents are aware of the risk of injury but a large number of producers 60 to 80% ignore the other health risks namely the risks related to contaminated food and chemical and microbiological risks. 50% of producers recognize the negative effects of their activities on animal life. At the environmental level, the proportion of those with knowledge of the presence of toxic elements in the air is very high at 93.93%. Only 34.80% of producers are aware of the risks of accumulation of toxic elements in crops. The analysis of perceptions reveals that less than 40% of producers agree that they have not observed any evolution of these diseases in their

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families and employees. The percentage of people with no information on animal health-pathology and death of animals is 57.57% and 63.63% respectively.

Keywords: Urban and peri-urban agriculture, urban waste, garbage disposal, health and environmental risks

1. INTRODUCTION

Urban and peri-urban agriculture is a present and important practice in many countries around the world (Magazine-AU, 2003). This form of agriculture uses urban waste produced by cities as the main source of soil fertilization. Waste is more produced in large quantities because of the urbanization galloping cities. For example, in Bobo-Dioulasso, solid waste production was estimated at 107,229 tonnes (Nouma, 2002). This waste consists mainly of household waste, industrial waste, biomedical waste, sewage sludge and excreta (Kabore, 2011 and al., Ye, 2007). The recycling of urban solid waste in agriculture is of particular agronomic interest. However, their use often shows constraints because of the risks linked, on the one hand, to excess nutrients (Sangare and al, 2012) and, on the other hand, to the content of undesirable elements (Ilboudo, 2011). In fact, urban waste contains organic and inorganic pollutants as well as pathogenic microorganisms. Thus, studies by Durand (2003) showed very high concentrations of inorganic pollutants such as sphyrenes, fluoranthoes, naphtalines in road sweeps. Also, according to Ye (2007), landfill waste from the city of Bobo-Dioulasso (Burkina Faso) has relatively high levels of heavy metals, in particular zinc (Zn) and lead (Pb). Also, chicken droppings contain high levels of Zn but low levels of lead (Ilboudo, 2011), and represent a potential for cadmium (Cd) soil contaminants (Locke and De Zeeuw, 2001). In manure, Daumer (2007) finds metal cations such as Zn, Cu, Pb. Manure spreading often causes excess nitrates and phosphorus in the soil, causing environmental problems such as eutrophication (Daumer, 2007 Halberg and al, 2010). Cotton ginning waste has relatively low levels of heavy metals (Pb and Zn) (Ilboudo, 2011). Also, slaughterhouse waste contains relatively high levels of Pb and Zn according to Ilboudo (2011). High levels of Zn have been observed on soils that have received chicken droppings (Olawale-Abulude, 2005). Copper and zinc were found in significant amounts in pig excrement (Moral and al., 2007). The positive and negative impacts mentioned above show that urban and peri-urban agriculture on the dumps is a double-edged sword. The use of urban waste in the fields, which makes farmers happy through good crop yields, is also at the root of several health and environmental risks (Magazine-AU, 2003). Indeed, cultures can be contaminated by pathogenic organisms such as bacteria, protozoa, viruses that can cause human diseases (malaria, dengue fever, encephalitis, lymphatic filariasis, etc.) and or animal diseases (bovine tuberculosis). and brucellosis) (Martin and al., 1987). Soil contamination by heavy metals (Waas, 1996) is an irreversible pollution problem for the long-term environment. The risks of injury, of disease of telluric diseases such as tetanus, meningitis etc. Exposure to incineration fumes can

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cause pulmonary diseases such as asthma, silicosis, anthracosis, asbestosis and chronic obstructive pulmonary disease (Zmirou and al., 2001). Contamination of crops and other plant species by bioaccumulation of heavy metals in soil and water (Senou and al., 2018). Contamination of the air by odors, smoke and toxic dust causez by the sorting and incineration of waste degrades the quality of the air. The breathing becomes difficult and the risks of pulmonary diseases very high. The research was conducted in four sites in Bobo-Dioulasso (western Burkina Faso) to assess the level of knowledge and perceptions of producers on the health and environmental risks of using garbage disposal in urban agriculture. The objective of this article is to present the knowledge of the producers and to make an analysis of their perceptions of the risks incurred in the use of waste disposal in agriculture.

2. MATERIAL AND METHODS

2.1 Study sites

The study was carried out in the urban commune of Bobo-Dioulasso (04 ° 20'W, 11 ° 06'N, 405 m altitude). The study is carried out at four sites located in the city. These were the sites of Dogona, Kodeni, Kuinina and Sector 22. The urban commune of Bobo-Dioulasso belongs to the South Sudanese climate and is located between the 900 and 1100 mm isohyets characteristic of the south-Sudanian climate (Fontès and Guinko, 1995). There is a dry season from November to May and a rainy season from May to October. Average monthly minimum temperatures range from 18 ° C to 25 ° C in May. Average monthly maximum temperatures range from 29 ° C in August to 37 ° C in March. Winds blow at an average speed of 2m / s in November to 3.5m in May. The average of the insolation varies from 5.6 hours in August to 8.7 hours in November. The average minimum relative humidity varies from 12% in February to 66% in August. According to (Fontès and Guinko, 1995), the vegetation is that of wooded savanna. It can be divided into three strata: tree, shrub and herbaceous. The shrub layer consists of *Combretaceae* and *Piliostigma* species (Hochst), *Daniellia oliveri* (Rolf) Hutch. and Dalz mostly in fallows. The tree layer is composed of species like *Vitelaria paradoxa* (CF Gaertn), *Khaya senegalensis* (Desr), *Gmelina arborea* (Roxb), *Parkia biglobosa* (Jacq Benth), *Detarium microcarpum* (Guill), *Tamarindus indica* (Linn), *Saba senegalensis* (Prota), *Isoberlinia spp* (Prota). The discontinuous herbaceous carpet is rich in *Andropogon spp* (Kunth), *Pennisetum* (Trin), *Eragrostis tremula* (Hochst) and *Srylosantes eracta* (Beauv). The soils of the town of Bobo-Dioulasso are of the ferralitic type. Their texture is kaolinitic clay in the B horizon, which gives them a satisfactory infiltration. The dominant soils are tropical ferruginous soils on various materials (sandy, sandy-clay, sandy-clay, etc.). They have a good relative humidity, but varies according to the season, the pH of soils generally vary between 5 and 6.5 (Pallo and al., 2008). Figure 1 shows the location of the study sites.

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2.2. Criteria for selecting sites

The four sites were selected on the basis of three criteria: (i) use of municipal solid and / or liquid waste as the main source of organic fertilizers, (ii) the size of the site must exceed 10 ha and (iii) the location of sites must be so to crisscross the city.

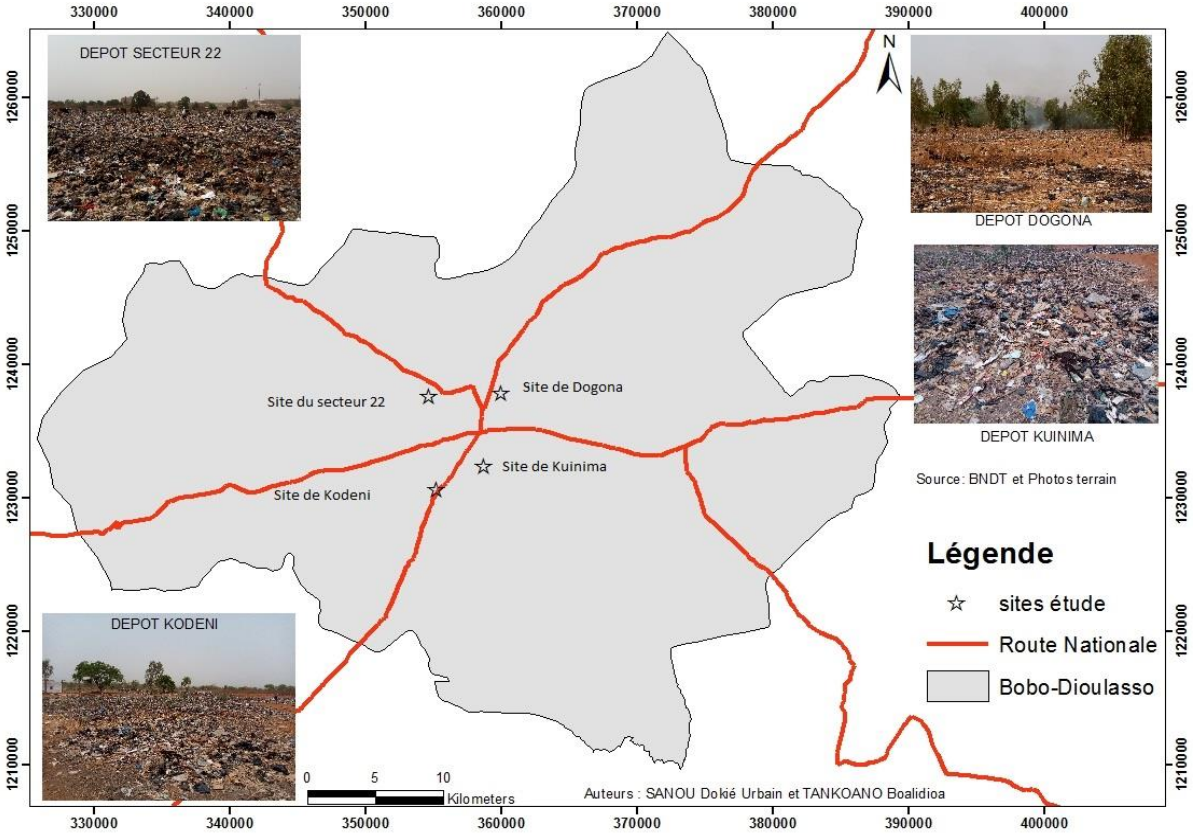

Figure 1: Map of location of study sites

2.3. Sampling and data collection

The data collection was done during a semi-structured interview using an individual survey form. The interview took place in the fields in the presence of the producer. The respondents were randomly selected from the sites. During the interview we let the producer express himself freely and we note on the card the answers which are the object of our study. A total of 64 producers were surveyed including 16 producers per site. The data collected from each producer concerned the socio-demographic characteristics (the level of education of the producer, the marital status, the size of these employees, the area exploited), the knowledge of the risks of using the waste as fertilizer (check the level of knowledge of the risks associated with waste on human health, the

environment and animals) and perceptions of the dangers associated with urban and peri-urban agriculture (assess the evolution of risks over time).

2.4. Statistical analysis of the data

The multi-varied analysis method was used because there is a diversity of answers to questions. The data were subjected to an analysis of variance (ANOVA) using the general linear model with the software Minitab (V. 14) for Windows (Minitab Inc.). The separation of the means was performed by the Tukey test at the 5% threshold. The Microsoft Excel 2010 software was used to generate the tables and graphs.

3. RESULTS

3.1. Sociodemographic characteristics of producers

The results of the socio-demographic characteristics of the producers are recorded in Table 1. They inform us that the latter consisted mainly of men with an average age ranging from 47 to 57 depending on the sites. Their level of education was relatively low, the majority having not reached the secondary level (90.62%). 80 to 100% of producers are married. The average area harvested per producer exceeds the hectare. The highest average area is noted on the Kodeni site (3.4 ha by producer).

Table 1: Distribution of the producers investigated according to sex, age, school level, statute and surface exploited

		Site of the sector			
Sites		**22**	**Dogona**	**Kuinima**	**Kodeni**
Sex (%)	Man	100	100	90,91	100
	Woman	0	0	9,09	0
Mean of producers investigated age		47	57	50	47
School level	University	1	0	0	1
	Secondary school	1	1	1	1
	Primary school	5	2	4	1
	Unschooled	9	12	11	14
Statute (%)	Wedded	80	100	90,91	100

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Single	20	0	9,09	0
Mean of surface exploited (ha)	1,23	2,2	1,16	3,4

3.2. Knowledge of risks to human health

Figure 2 shows the health risks for producers in the different sites. Regardless of the type of risk and the site, more than 60% of producers are aware of the risks to their health (Figure 2). Accidental risk is the best known of producers. The proportion of producers who are aware of this risk is 100% regardless of the site. Moreover, apart from the food risks whose number of positive answers is globally lower than 60%, all the other risks are around 80%. In descending order, the site with the highest number of producers with knowledge of the risks to human health is Kodéni followed by the site of sector 22, Kuinima and finally Dogona.

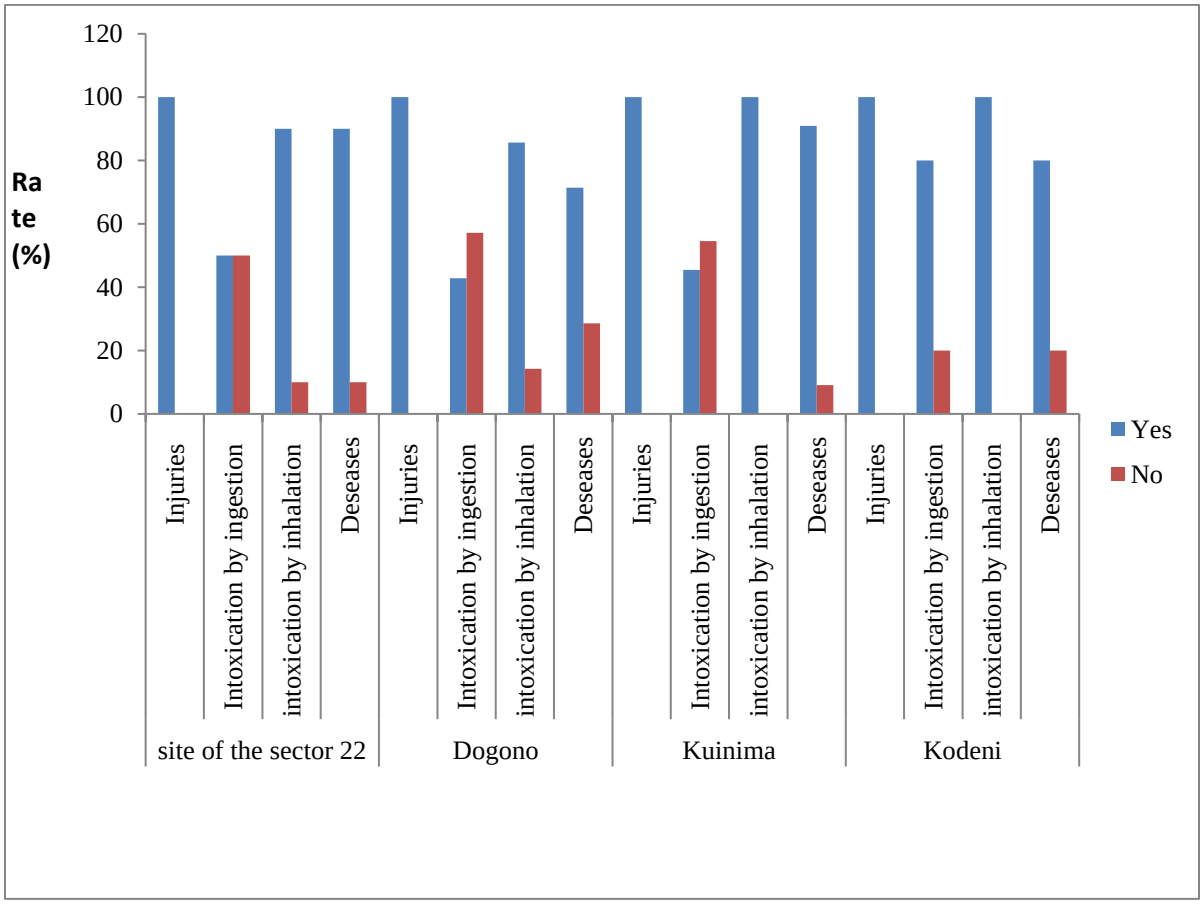

Figure 2: Knowledge of risks to human health

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3.3 Knowledge of risks to animal health

The knowledge on animal health concerned three risks namely the possibility of accumulation of toxic elements by aquatic populations (fish, etc.), domestic animals and their derivatives (egg and milk). Figure 3 shows the proportions by type of risk and sites. The results show a difference in the knowledge of the risks according to the type and according to the site. The Kodéni and Kuinima sites recorded more positive responses, unlike the Dogona and Sector 22 sites, where the majority of producers do not have knowledge of the animal health risks of urban and peri-urban agriculture risks on landfills. garbage. As for the risks, the least known by the producers was noted in terms of the risk of presence of toxic elements in milk and eggs (70% of producers) on the site of the sector 22. The best known risk was the presence toxic elements in the meat.

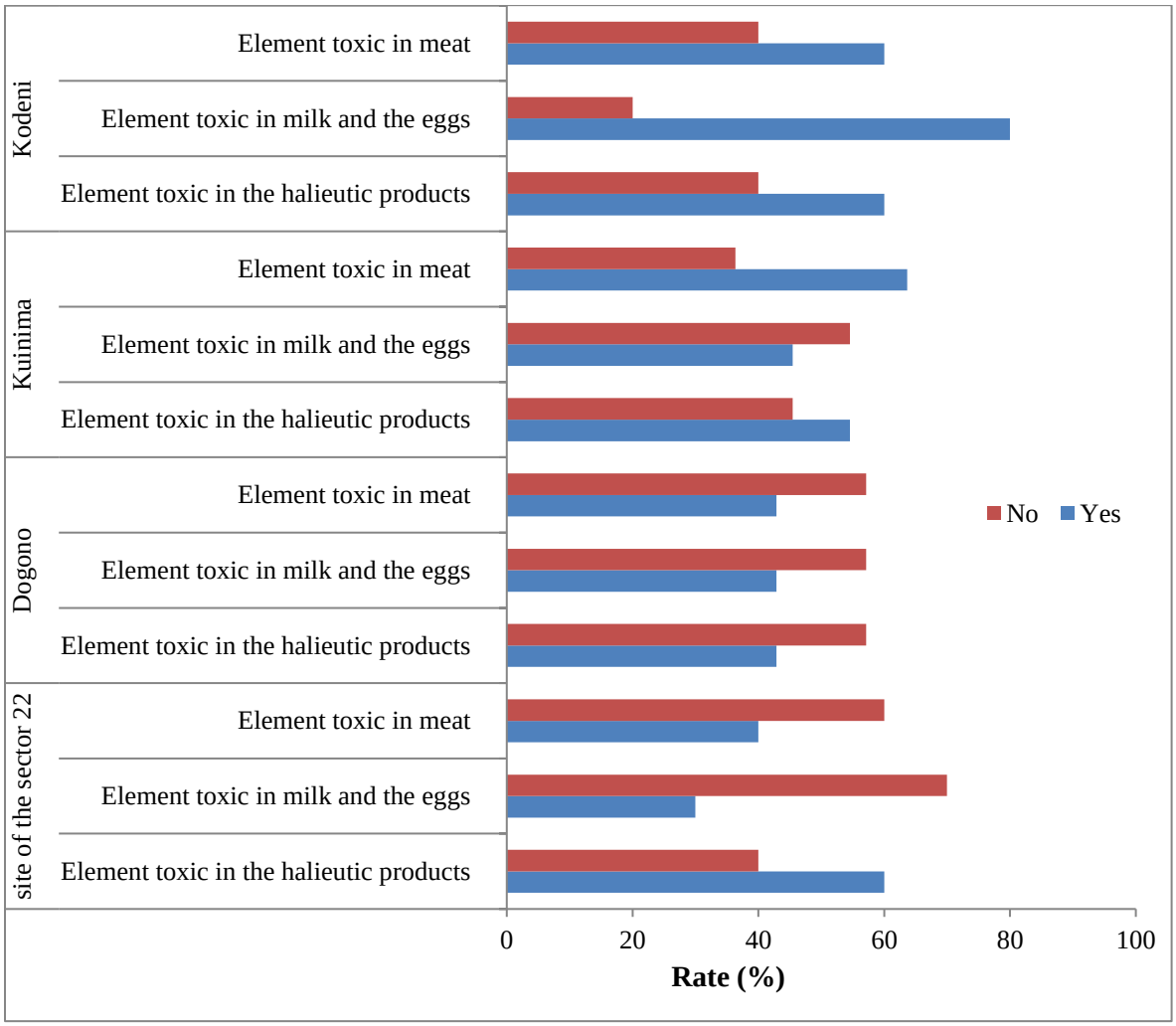

Figure 3: Knowledge of risks to animal health

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3.4. Knowledge of risks to the environment

Figure 4 shows the level of knowledge of producers on environmental risks. The knowledge of environmental risks related to urban and peri-urban agriculture on waste disposal varies according to the sites and the types of risks. The proportion of knowledge of the presence of toxic elements in the air is highest (93.93%); the least known risk being the accumulation of toxic elements in crops (34.80%). The Kuinima site is where producers are most aware of these risks, followed by Kodéni de Dogona and the site of sector 22 as shown in Figure 4.

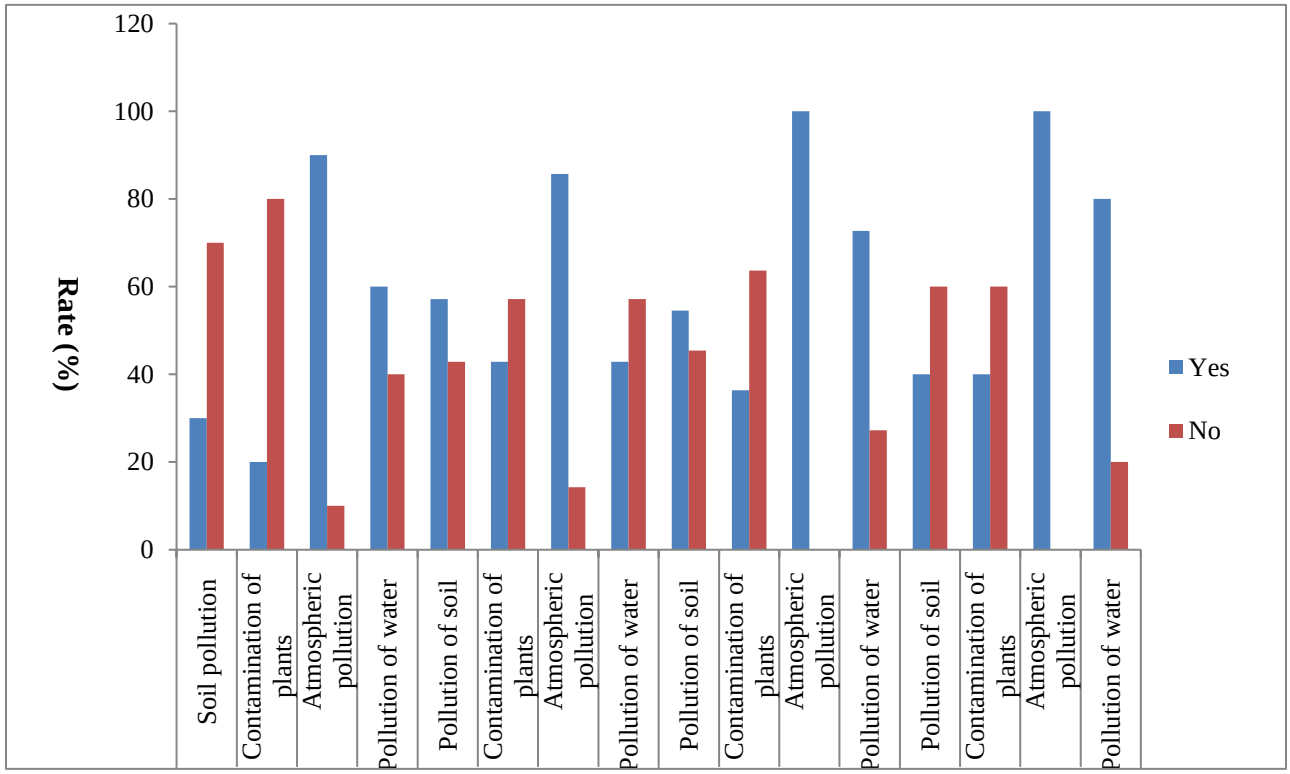

Figure 4: Knowledge of risks to the environment

3.5. Perceptions of the dangers of urban and peri-urban agriculture on human health

Figure 5 presents the perception of the dangers on the health of the producers. The results reveal that about 40% of producers do not have an idea about the frequency of these diseases in their surroundings. Less than 40% of respondents agree that they have not observed any change in these diseases in their families and employees. Despite this finding, at least 15% of the producers surveyed said that these diseases have increased in recent years. The most cited are skin diseases (54.17%), respiratory diseases (32.12%), digestive disorders (9.51%) and vector diseases (4.2%). The perception of producers of the dangers of urban and peri-urban agriculture on human health

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remains very variable within the same site. On the other hand, their perceptions differ from one site to another.

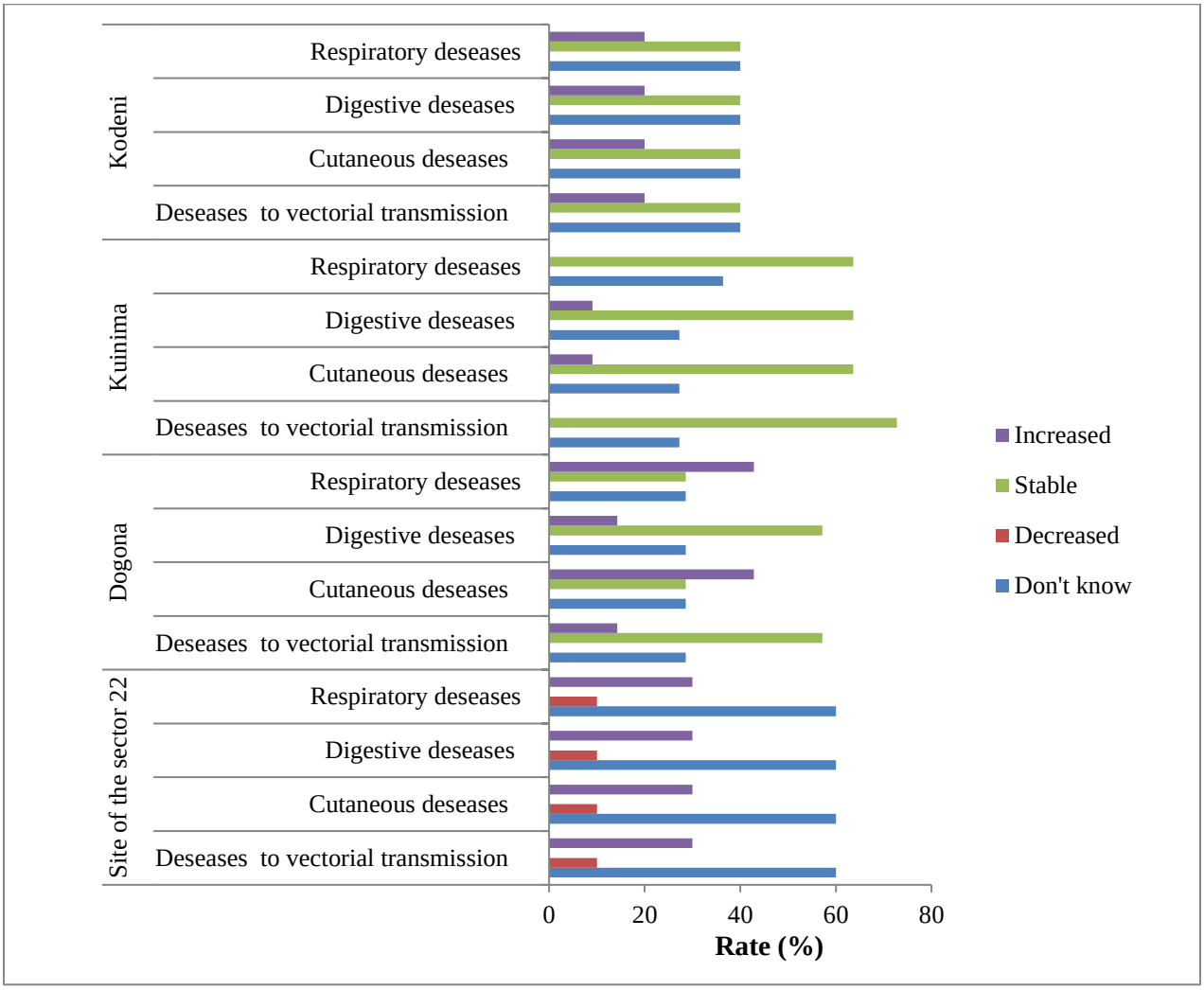

Figure 5: Perceptions of the dangers to human health

3.6. Perceptions of the dangers of urban and peri-urban agriculture on animal health

The producers surveyed, regardless of the site, have no knowledge of the different diseases that can affect animals. To do this, we have used the term "animal health-pathology" to designate all these diseases. Regardless of the site and the type of risk, the producers showed an approximately identical perception. This explains the use of reduced histograms to present these results (Figure 6). It is noted that 57.57% and 63.63% of producers do not have information on animal health-pathology and death of animals respectively. However, 24.24% say that there has

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been an increase in animal diseases and 15.15% of respondents say they find an increase in the number of deaths in domestic animals. Only 3.03% of producers in each category certify that there is a decrease.

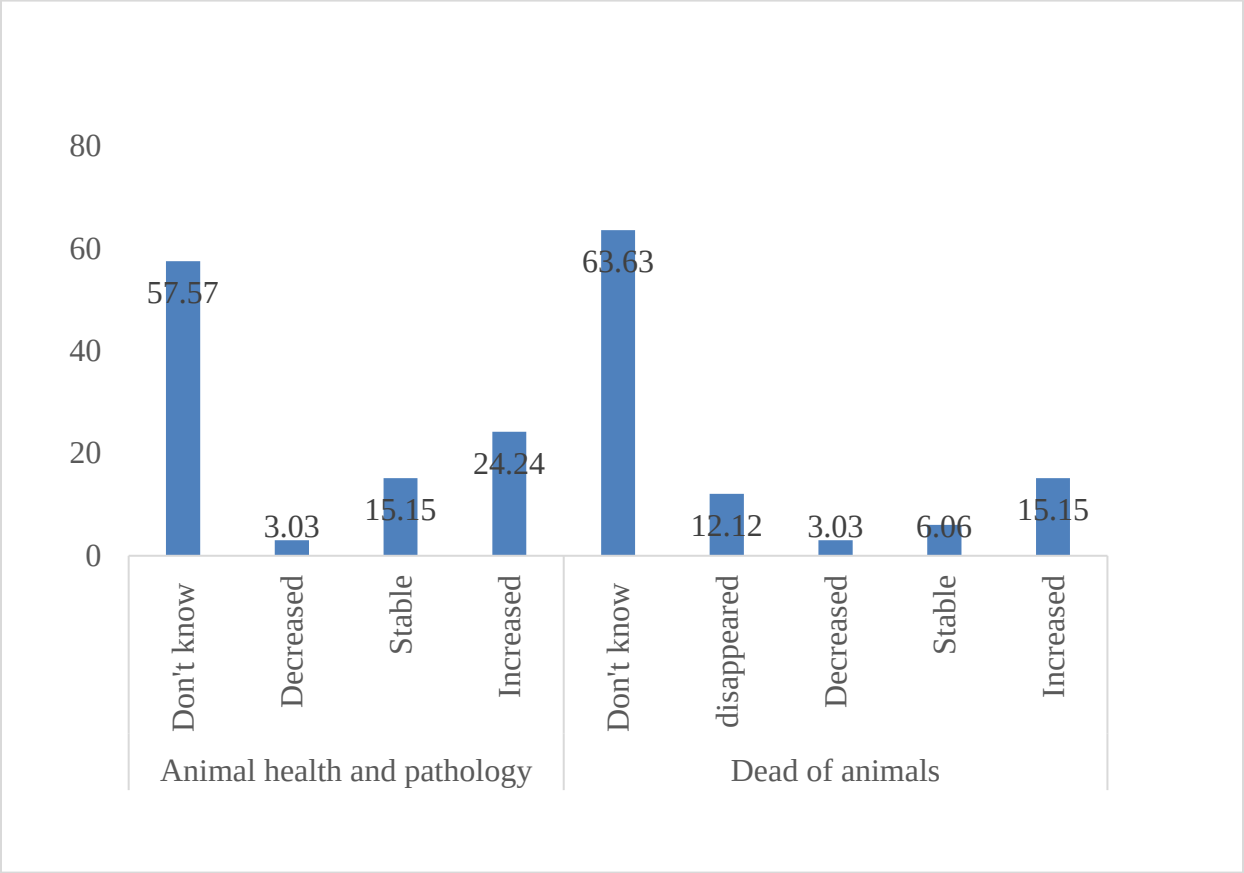

Figure 6: Perceptions of the dangers on animals

3.7. Perceptions of the dangers of urban and peri-urban agriculture on the environment

Table 2 presents the perception of producers about changes in their environment. More than half of the respondents agree on the deterioration of the quality of the elements of the environment. Air quality is the element of the environment that has deteriorated the most over time. It is estimated at 90% and 90.91% respectively for the producers of the sector 22 and Kuinima site. On the Kodéni site, 60% of the producers think that the elements of the environment in this study are degraded. The quality of the air is perceived less degraded by 60% of the respondents on the Kodéni site; lower value compared to the other three sites. The site of sector 22 is the place where the dangers to the environment are higher compared to other sites.

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Table 2: Perceptions of the dangers on environment

Sites	Perceptions of the dangers on environment	Answers	Rate (%)
Site of the sector 22	Quality of air	Degraded	90
	Quality of the water of well	Degraded	60
	Quality of the surface water	Degraded	90
Dogona	Quality of air	Degraded	74,43
	Quality of the water of well	Degraded	74,43
	Quality of the surface water	Degraded	57,14
Kuinima	Quality of air	Degraded	90,91
	Quality of the water of well	Degraded	63,64
	Quality of the surface water	Degraded	54,55
Kordéni	Quality of air	Degraded	60
	Quality of the water of well	Degraded	60
	Quality of the surface water	Degraded	60

3.8. Link between knowledge of risks and the level of education of the producer

Figure 7 shows that farmers' knowledge of the risks and dangers of urban and peri-urban agriculture on garbage disposal is largely influenced by their grade levels. Figure 7 shows trend curves of the two series of parallel points. This shows a relationship between the level of education and the level of knowledge of the risks of producers. The link between risk knowledge and grade level is higher with the level of the producer. The correlation is positive ($R > 0.8$) for the upper level and negative ($R < 0.5$) for the other three levels.

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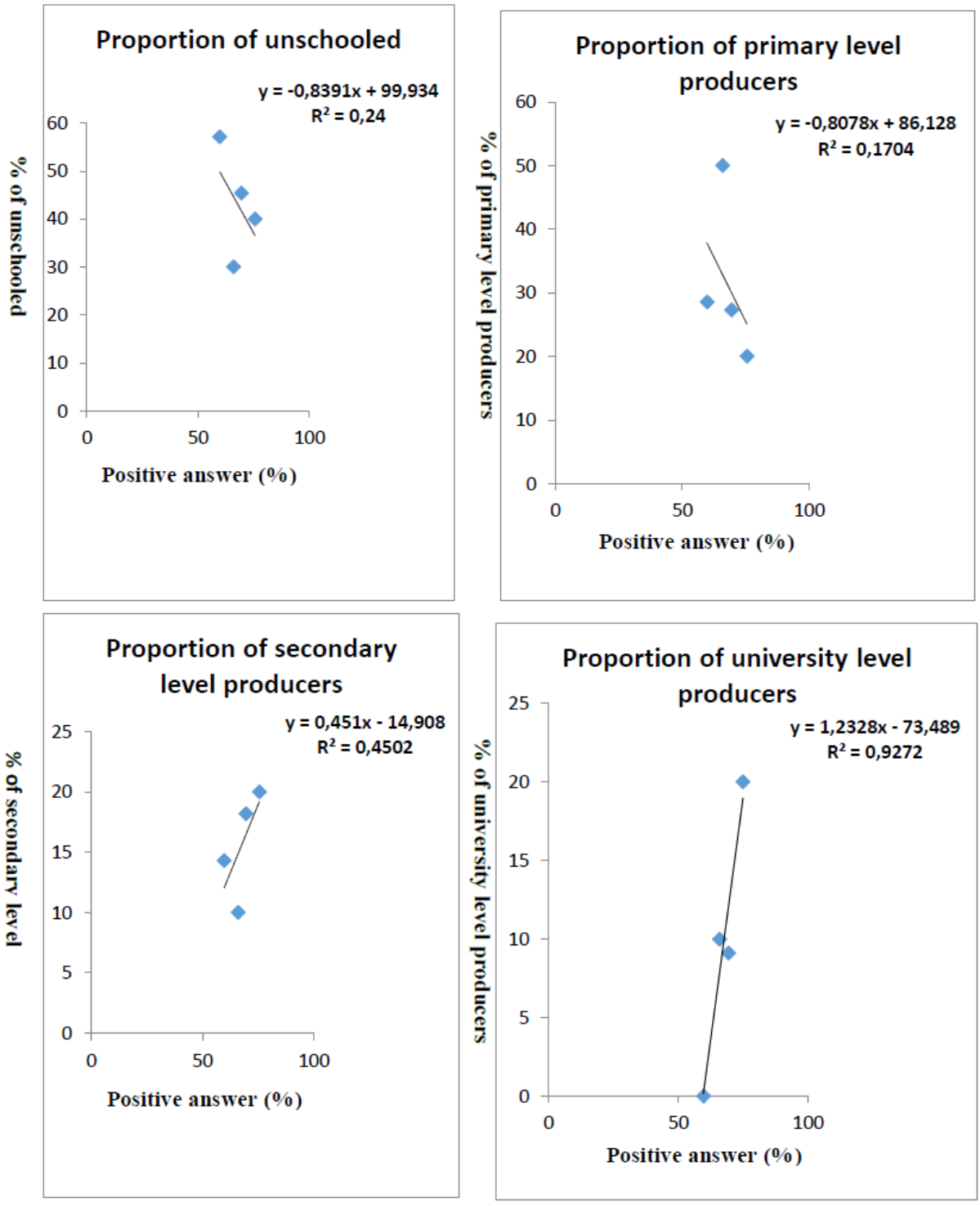

Figure 7: Link between knowledge of risks and the level of education of the producer

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4. DISCUSSION

The results showed that producers do not have a great knowledge of the health risks of their agricultural production activities on garbage disposal. Indeed, the knowledge of these risks is low on certain sites, 50% on the site of the sector 22, 42,86% on Dogona and 45,45% on Kuinima and 80% on Kodeni. They have no notion of the transfer of toxic elements from the soil to plants or from plants to animals. The educational level could explain these low proportions because only 18.18% of producers finished primary school. They also testify that they have not received any support from state agents or other structures, proving that they do not have training in good agricultural practices, in this case on health risk preservations. The results obtained corroborate those of (Wognin and al., 2013). The surveys they conducted on two market garden sites in the city of Abidjan showed that 81.3% of market gardeners of the first site attested to not knowing the risks related to market gardening practices against 64.94% for the second site. The informal nature, the high level of illiteracy and the lack of training programs on good practices in urban farming could justify the ignorance of producers.

Some producers, on the other hand, know the risks but endure them either to save money or because they lack means of production and protection. A minority of producers are aware of the risks. However, it is often difficult to get farmers, especially small, poor producers, to change their behaviors using risk-reduction practices because food production using waste generates significant livelihood opportunities (Buechler et al. Devi (2005a, 2005b), Hamilton and al (2005), Toze, (2006) Producers act primarily with positive and short-term economic effects on their livelihood, although they may understand the negative and long term on health.

In addition, producers testify to being wounded more than once by sharps and tangles hidden under the garbage. However, only a few wear protective equipment. This finding confirms that of Knudsen et al., 2008 and Amoah and al., 2007, in a study conducted in Ghana where only 19% of farmers wore protective clothing (boots and gloves) not because of health risks, but to protect against injuries due to cold and physical injury.

Like health risks, producers do not have much knowledge of the impact of waste or their agricultural practices on the environment. They ignore the existence of toxic elements in the waste that can be found in the soil and in the tissues of crops. Producers need concrete and short-term effects to convince themselves of the existence of such elements in soil and agricultural products. Some think that the crops will dry up or that the grain will feel bad if the waste contains toxic elements. This reasoning of the producers shows that they lack a certain level of knowledge and training to apprehend these risks.

In contrast, 78.84% of producers recognize the nuisance of bad odors from waste. In the Kuinima site, producers prohibit the emptying of sewage sludge and wastewater that gives off pestilence

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odors. These results support those of Riesenmey (2008) who identified 371 complaint filings in 10 years in England. On the one hand, local residents complain about the inconvenience linked to the perception of odors, and on the other hand the risk incurred by people regularly inhaling the air polluted by the site. The latter are mostly producers or consumers. During the rainy season, runoff water causes waste in wells without curbs. No farmer drinks it, proving that they are aware of the dangerousness of this polluted water. However, rare are those who know that the toxic elements contained in the waste can be dragged up to the water table. The minority of producers, who are aware of the risk to the environment, pretend to ignore it or become disempowered. According to Michel-Guillou (2009), 17% of producers do not recognize being responsible for water pollution and report that the causes of pollution of the environment are elsewhere.

5. CONCLUSION

In the face of health and environmental problems related to the use of garbage disposal in urban and peri-urban agriculture, it is important to know and understand the point of view of producers. At the end of this study, it appears that the proportion of producers who know about the health risks is 51.85% and those who are unaware of the environmental risks 40.49%. Less than half are aware of the contamination of animal products by the toxic elements contained in the waste. The comparison of these values by site ranks the site of sector 22 in first position followed by the site of Dogona, Kodéni and Kuinima. About 40% of producers not an idea about the frequency of diseases in their surroundings. Fewer than 40% agree that they have not observed any change in these diseases in their families and employees. As for animal health, 8 out of 33 people say that there has been an increase in animal diseases and 5 out of 33 report an increase in the number of deaths in domestic animals. Nearly 70% of producers believe that the environment is deteriorating. At the end of this study, it can be concluded that while some producers do not know about the risks involved in producing rubbish dumps, others know that, but for economic reasons, they neglect these risks. In terms of risk perception, the majority of producers do not perceive the health and environmental risks associated with the use of garbage disposal in agriculture.

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