Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6202

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (1):** 16-24 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Characteristics and Typologies of Production Units in Urban Agriculture in Area of Bobo-Dioulasso (Burkina Faso)

SENOU Issaka[1*], OUEDRAOGO Jean[2], Sanou D. Urbain[4], NACRO H. Bismarck[3] and SOME N. Antoine[1]

[1]Laboratoire des Systèmes Naturels, des Agrosystèmes et de l'Ingénierie de l'Environnement (Sy.N.A.I.E), Institut du Développement Rural (I.D.R), Université Nazi BONI (U.N.B) Bobo-Dioulasso ; BP 1091, Bobo-Dioulasso, Burkina Faso

[2]Institut de l'Environnement et de Recherches Agricoles (IN.E.R.A), 04 BP, Ouagadougou 04, Burkina Faso

[3]Laboratoire d'étude et de recherche sur la fertilité du sol (L.E.R.F), Institut du Développement Rural (I.D.R), Université Nazi BONI (U.N.B); BP 1091, Bobo-Dioulasso, Burkina Faso

[4]Direction Régionale du Ministère de l'Agriculture et des Aménagements Hydrauliques/ Sahel (Dori), Burkina Faso

*Corresponding Author E-mail: issakasenou@gmail.com

Received: 5.01.2018 | Revised: 7.02.2018 | Accepted: 10.02.2018

ABSTRACT

The urbanization of Burkina Faso produce urban waste in large cities. Some poor urban populations use this waste as fertilizer in urban and peri-urban agriculture. Our study was conducted on sites used in urban and peri-urban agriculture in the city of Bobo-Dioulasso (Burkina Faso). The study aims to characterize the production units and define the typologies of these units. Surveys were carried out with 70 heads of production units in four sites. The data collected concerned the age of the farm manager, the size of the production unit, the level of education and training, the land status, the level of equipment, the nature of the waste. On the basis of these characteristics, the production units have been defined.

The results indicate that the age of heads of production units is between 20 and 60 years with an average of 34 years. Only 2.80% were trained in agriculture and 9.10% are educated. 78% of production units are manual and household waste is the most used (38 to 70%). These results highlight a diversity in the production units. Thus, 5 types of production units were defined with greater representativity of type I production units; characterized by a manual production system and a planted area of about 78% of their total area. The size of the fields, the age of the heads of production units, the experience and the rate of development are the factors which discriminate exploitations chiefs.

Key words: *Production unit, Typologie, Surveys, Bobo-Dioulasso, Burkina Faso.*

Cite this article: Issaka, S., Jean, O., Urbain, S.D., Bismarck, N.H. and Antoine, S.N., Characteristics and typologies of production units in urban agriculture in area of Bobo-Dioulasso (Burkina Faso), *Int. J. Pure App. Biosci.* **6(1):** 16-24 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6202

INTRODUCTION

Urban agriculture is made up of a variety of agricultural and pastoral activities that can take place within or around urban areas[1]. This definition of urban agriculture is the same interpretation that FAO gives to urban and peri-urban agriculture. According to[2], urban and peri-urban agriculture consists of growing plants and raising animals in and around cities. It provides food products of plant origin (seeds, root crops, vegetables, mushrooms, fruits) and animal products (poultry, rabbits, goats, sheep, cattle, pigs, guinea pigs, fish, etc.), as well as aromatic and medicinal herbs, ornamental plants, forest products, etc. Today, there is a consensus to consider urban agriculture in the broadest sense that is to say by including peri-urban agricultural activities as indicated[3]. 60% of humanity live in urban areas since 2014 and forecasts in 2050 are 80% with more than 3 billion inhabitants on earth[2]. 800 million people around the world are involved in urban agriculture and contribute to the food of urban residents[2]. Urban and peri-urban agriculture thus contributes to household food security, especially since locally produced foods are fresh, nutritious and at competitive prices because they are transported over short distances and require less storage[4]. Urban agriculture plays an important role in the developing countries where it is, on the one hand, the receptacle of a large part of the young unemployed and on the other hand a source of fresh agricultural produce. However, cities are characterized by high population densities, strong competitions for the use of space, and frequently observed environmental pollution (soil, water and air). These characteristics have consequences on the forms of urban agriculture. Cultivating edible plants in the city involves dealing with several constraints such as the optimization of available space, the control of the exposure of populations to the pollutants often present in the various environments (soils, water, air) and therefore also the reducing the environmental impact of these urban crops (through the reduction of inputs and the recycling of organic matter in particular)[5]. Different actors are involved in the development of urban agriculture: citizens, elected officials, researchers, professionals in the sector. These various categories of actors have different and sometimes divergent objectives. Within these categories, the uses of space and financial issues are being put in place[5]. According to[6], the process of concentration of populations in urban areas has multiple origins: a strong rural exodus started with the industrial revolution and other social changes reinforcing the attraction of cities. In addition, many local authorities have understood the importance of the social and ecological benefits of urban amateur and professional agriculture that reinforce the presence of nature in the city. So many and varied projects of urban agriculture are developing in the cities of the world[7, 8] : urban market gardening areas, collective gardens possibly on rooftops [9] and private vegetable gardens, fruit trees present in collective habitats ... Thus, the objective of this present study was to (i) characterize production units in urban agriculture and (ii) define the typology of these production units.

MATERIAL AND METHODS

Study Area

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 Dogona, Kodéni, Kuinina and Sector 22. The Bobo-Dioulasso urban district belongs to the South Sudanese climate and is located between the 900 and 1100 mm isohyets characteristic of the South Sudanese climate[10]. 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. Mean 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 sunstroke 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 [10], the vegetation is that of the wooded savannah. 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 such as *Vitelaria paradoxa* (CF Gaertn), *Khaya senegalensis* (Desr), *Gmelina arborea* (Roxb), *Parkia biglobosa* (Jacq Benth), *Detarium microcarpum* (Guill), *Tamarindus indica* (Linn), *Saba senegalensis* (Prota), *Isoberlin*ia 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 soil pH generally between 5 and 6.5[11]. Figure 1 show the location of the study sites.

Criteria for selecting sites

The four sites were selected on the basis of three criteria: (i) use of urban 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.

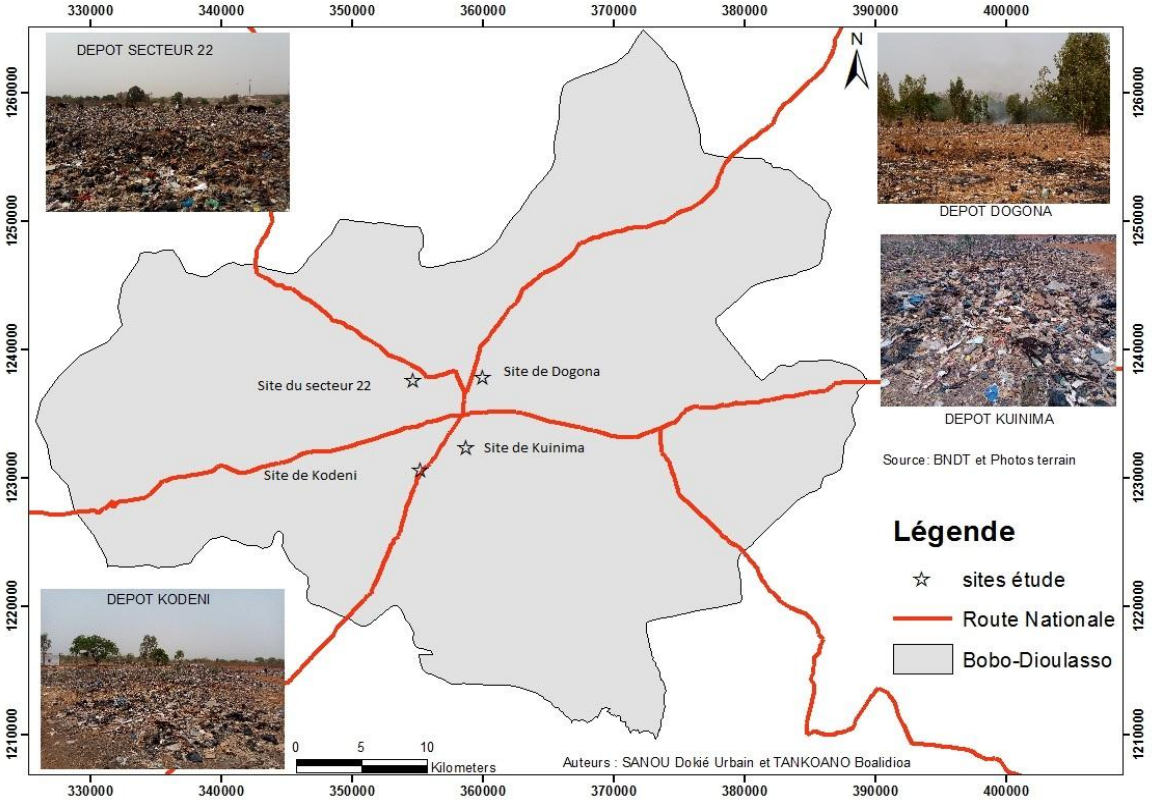

Fig. 1: Map of location of study sites

Sampling and data collection

Data was collected at four sites that met the site selection criteria. These are the Dogona, Kodéni, Kuinina and Sector 22 sites. The questionnaire was sent to the heads of the production units at each site. The choice fell on the farm managers having at least an area greater than 0.50 ha and whose production year is greater than or equal to 2 years on the site. In total, 70 farm managers were surveyed, 29 of which were for the Sector 22 site; 23 for the Kuinima site; 8 for the Kodéni site and 10 for the Dogona site. An individual survey sheet was prepared to conduct the interviews. The data collected from the heads of each farm unit concerned: the age of the farm manager,

the size of the farming unit, the level of education, the land status, the level of equipment, the nature of the farm, waste used as agricultural fertilizer.

Basic criteria for typology

The typology is a tool for classifying holdings according to one or several groups of criteria. It constitutes one of the means of appreciation of the diversity and dynamics of production systems. From this perspective, benchmarking is useful. The criteria used as a basis for the typology are:

- age: it is the most appropriate criterion for understanding the motivation and decision-making of peasants;
- the level of education and training: it is the most appropriate criterion to know the level of the producer to understand and want to improve the good agricultural practices but also to understand his motivation and the choice of decision in the conduct of cultures ;
- the useful / active agricultural area which represents the surface area developed per worker. This criterion, useful for the comparison of different production systems;
- the level of equipment: it indicates not only the degree of openness to the progress of the farm but also it's potential technical level.

Statistical treatment of data

The multivariate analysis method was used because there is a variety of answers to questions. The XLSTAT software 2015.4.01.21575 was used to perform a Principal Component analysis (PCA) on the data related to the characteristics of the production units. The definition of the typology was carried out by adopting the method of[12]. It has made it possible to form homogeneous groups of producers. The Microsoft Excel 2010 software was used to generate the tables and graphs.

RESULTS

Characteristics of the production units surveyed

Table 1 shows that the heads of the production units surveyed are between 20 and 60 years old with an average age of 34 years. The farms interviewed have an average number of 5 people with 3 assets on average. These farms have an average of 4 ha with a total area of 5 ha. The average share of developed area per worker is 1.33 ha for a development rate of 33%. The average experience of the heads of production units is 6 years. Table 2 indicates that a very small proportion of producers (<10%) have been trained in agriculture and are also uneducated, that is, likely to read the recommendations on a label. Only 4 producers received training in agriculture and 13 are educated, respectively 2.80% and 9.10% of all producers. Table 3 shows that the land ownership status of the production units is dominated by inheritance with 57%, followed by donation with 36%, ie 40 and 25 production units respectively out of 70. In Dogona and Kodéni, all production units are acquired by inheritance. On the other hand, in Kuinima and Sector 22, the land status is mainly the gift with respectively 52 and 46% of the units of production surveyed. However, no production unit was acquired by purchase regardless of the site.

Table 1: Descriptive statistics of the production units surveyed

Variable	Minimum	Average	Maximum
Age HPU (year)	20	34	60
Number of persons	3	5	10
Number of assets	2	3	5
AT (ha)	2	5	12
AA (ha)	1	4	8
AA/ Assets (ha)	0,5	1,33	1,6
RE (%)	25	33	67
Experience HPU (year)	2	6	15

Legend : HPU = Head of the Production Unit, SAT = Total Agricultural Area, AA = Agricultural Area RE = Rate of Enhancement

Table 2. Training and education level of the heads of the production units

Variable	Study sites				Numbers	Average
	Dogona	Kodéni	Kuinima	Sector 22		
Trained	5%	7%	8%	3%	4	2,8%
Educated	20%	18%	22%	15%	13	9,1%
Trained and educated	2%	6%	12%	4%	5	3,5%

Table 3: Land status of production units

Variable	Study sites				Numbers	Percentages
	Dogona	Kodéni	Kuinima	Sector 22		
Inheritance (Owner)	100%	100%	44%	40%	40	57,0%
Don	0%	0%	52%	46%	25	36,0%
Ready-rental	0%	0%	4%	14%	5	7,0%
Purchase	0%	0%	0%	0%	0	0,0%

In the study sites, production systems range from motorized to manual. The motorized production units are only met in Kuinima and represent only 4% of the workforce of this site or 1.64% of all production units. The majority of production units are manual with 78% of respondents. The highest is obtained in the site of Sector 22 with 97% of producers. Only 20.64% of production units are hitched. However, according to the sites, the latter represent 3% to 44% of the production units (Figure 2). Figure 3 shows that the waste used in the different production units has four types: household waste, sewage sludge, medical waste and industrial waste. Household waste is the most represented with 38% to 70% followed by sewage sludge with 20% to 26% of all waste. There is a large amount of industrial waste (25%) on the Kuinima site. On the other hand, in Dogona, we note the absence of this type of waste but with a large proportion of household waste (70%) compared to other sites. Medical waste is poorly represented regardless of the site. Depending on the site, they represent 9% to 15% of the waste.

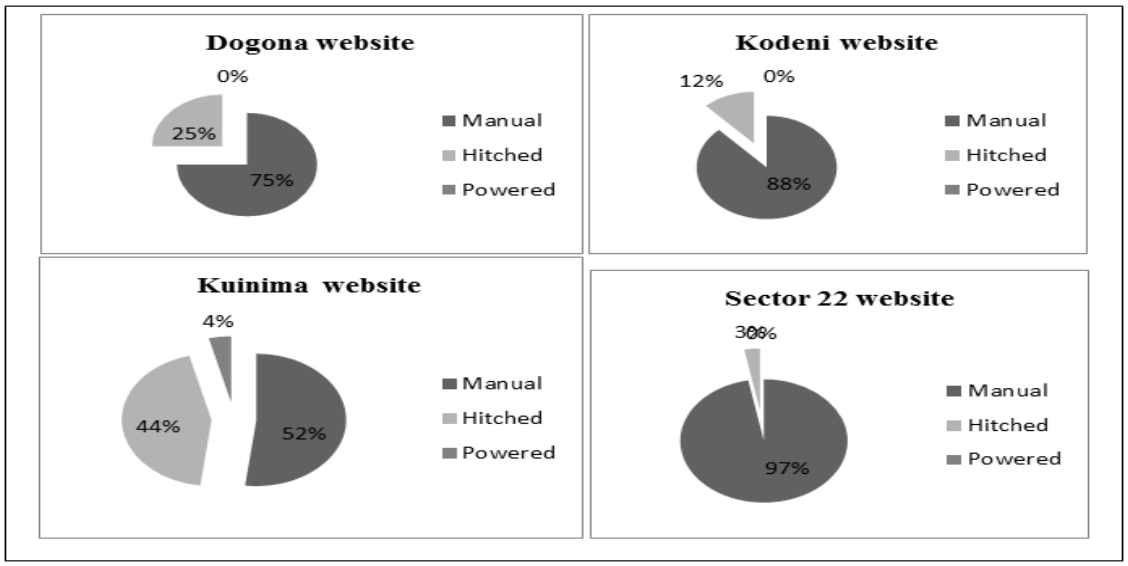

Fig. 2: Level of equipment per site

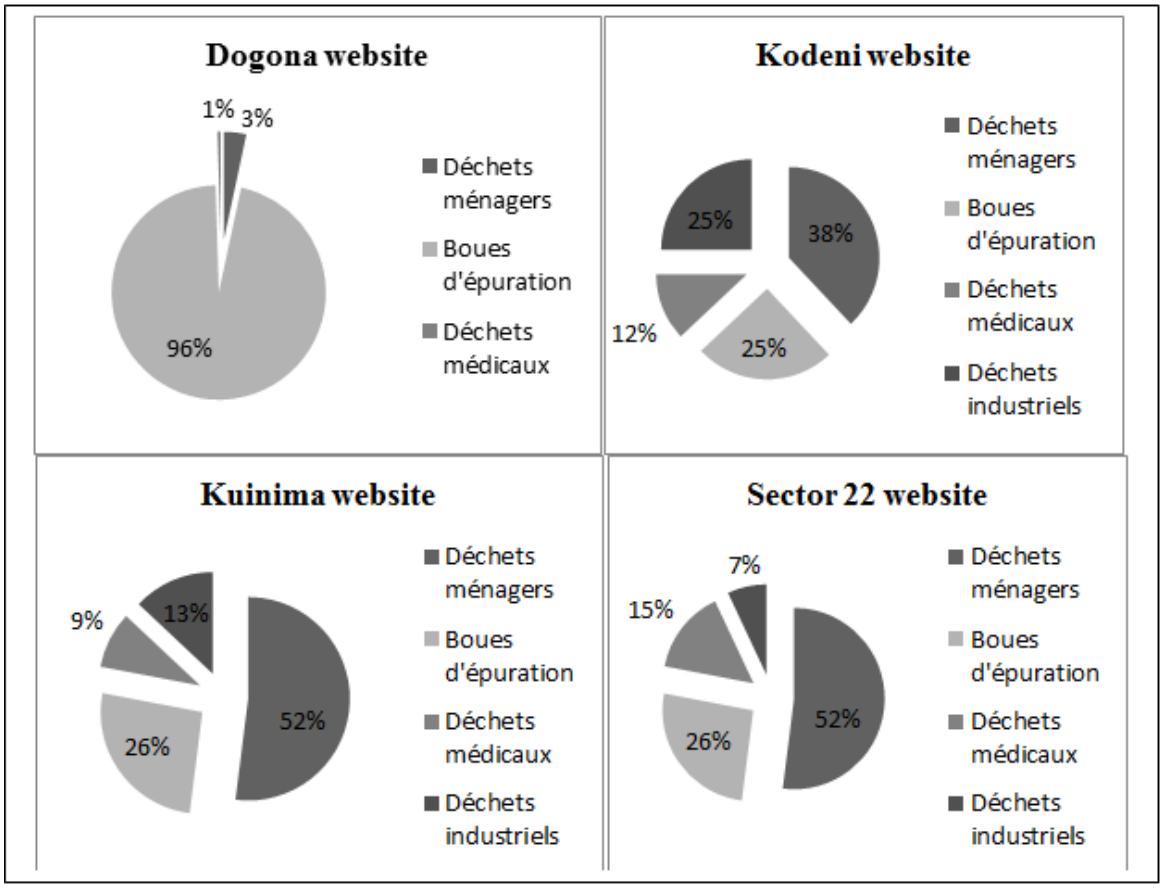

Fig. 3: Types of waste per site

Constitution of classes and typology of productions units

Table 4 presents the class indicators for the classification of production units. The characteristics of the production units are given in Table 5. They are divided into 5 production units (Table 5).

Table 4: Class Indicators

Indicators	Class I (n= 40)	Class II (n= 18)	Class III (n= 12)
Age HPU (year)	] 20 - 30]	] 30 - 50]	] 50 et Plus]
Instruction and training of the HUP	Trained	Trained and educated	Trained
Level of equipment	Manual	Hitched	Powered
AA/ Assets (ha)	] 1 - 1,6]	] 0,5 - 1]	] 0,5 - 0,8]

Legend : HPU = Head of the Production Unit, AA = Agricultural Area

Table 5: Characteristics of typologies

Type of production units	Characteristics
I	Manual production unit, guided by a non-educated and untrained chef who has acquired the land by inheritance and guided by a chef whose age is less than 30 years. The surface area represents 78% of the surfaces of the people surveyed.
II	Manual production unit, guided by a non-educated and untrained chef who has acquired the land by inheritance and guided by a chef whose age is less than 30 years. The area represents more than 60% of the surfaces of the people surveyed.
III	Hired production unit, guided by a trained chef who acquired the land by donation or loan and guided by a chef aged between 30 to 50 years. The surface area represents 20, 64% of the surfaces of the people surveyed.
IV	Hitched production unit, guided by an uneducated chef who acquired the land by loan and guided by a chef whose age is between 30 to 50 years. The surface area represents less than 20% of the surfaces of the people surveyed.
V	Motorized production unit, guided by an educated and trained chef who bought the land on loan and was guided by a chef who is over 50 years old. The area represents less than 2% of the surfaces of the people surveyed.

Figure 4 gives the characteristics of the production units of the producers surveyed. There is a small proportion (6%) of type V in the sites. It does not even exist in the samples of Dogona, Kodéni and Kuinima. Type I production units are the most representative in the study area (40%) and followed by Type II with 35%. Type IV production units constituting the least developed represent 9% of units. Type III production units are intermediate units in the coupling or motorisation phase. Indeed, these last ones have a potential to evolve towards the higher types.

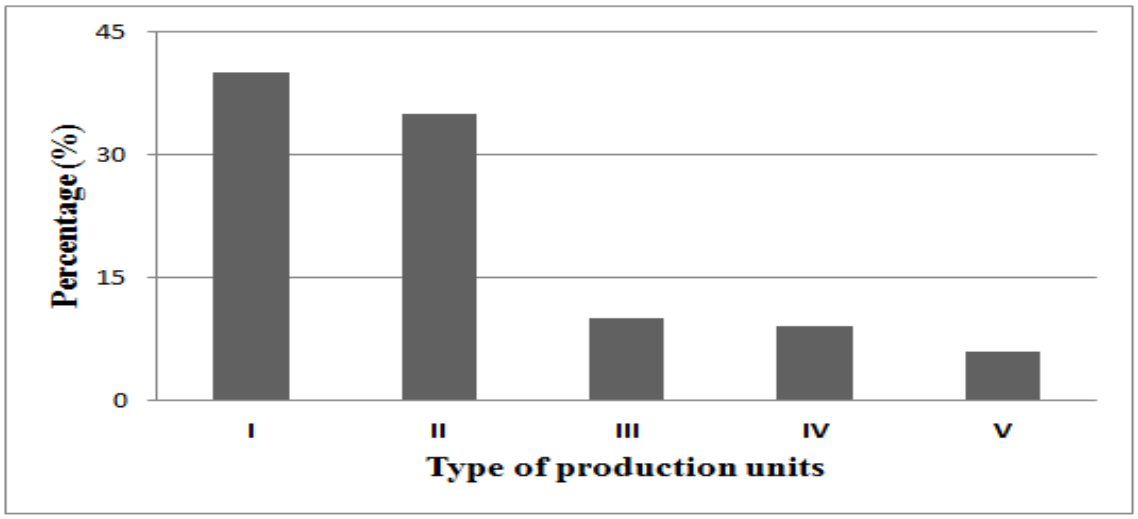

Fig. 4: Typology of production units

DISCUSSION

The results of the descriptive statistics of the units of production indicate that the heads of the units have an average age of 34 years. These results corroborate those of[13] where the average age is 30 years with a proportion of 38% of cereals and 69% for nurseries and market gardeners at the sites of the urban area of Ouagadougou. These results are also similar to those of[14] in Kadiogo Province (Burkina Faso) and[15] in Tuy Province (Burkina Faso). The average data on the number of assets and the total area of cultivated fields are also similar to those of[15]. If we consider the rates of development of available and cultivable land, we can say that land is more or less a scarce resource on these sites. The average development rate of 33% already suggests weak pressure on site lands. However, producers claim that parts of non-planted sites are reserved for grazing or because they have low agricultural value (very rugged or heavily leached). They point out that if it had not been for the use of waste as fertilizer, many areas would have a poor productivity. The results on the level of education and training of heads of units give respectively 2.80% and 9.10%. These results are corroborated with those of[13,16] which showed that more than 60% of grain farmers and market gardeners in the urban area of Kadiogo (Burkina Faso) are uneducated and untrained in agriculture.

In all four study sites, 57% of the producers own their land. This high proportion is due to the predominance of non-native people at the sites. These results confirm those of[17] which indicate 81.25% of inherited land access mode in the western zone of Burkina Faso.

The majority of production units are manual (78%). This could be explained by the lack of financial resources of the farm managers but also the narrowness of the plots. These results are in agreement with those of[14] which indicate a level of manual equipment ranging from 80 to 90% in the Center of Burkina Faso. The level of manual equipment is 83.33% at the Wayalghin site, (86.2%) at the Paspanga site, (89.65%) at the Tanghin site and 80% at the Boulmiougou site[14].

Urban waste used in production units as a source of field fertilizer consists mainly of

household waste (30 to 70%). This could be explained by the fact that these sites are close to the houses and that the population pours their waste directly into it. These results are similar to those of[13], which show that most urban agricultural sites in the cities of Ouagadougou and Bobo-Dioulasso (Burkina Faso) use household waste as the main source of fertilization of plots. Moreover, this could also be explained by the significant production of waste in the city but also the management difficulties for the municipal technical services of the city. The results of the work carried out by[18] estimate the amount of municipal waste to be around 100.000 tonnes/ year. The majority of this waste is found on these sites, sometimes at the request of the operator. In addition, these household wastes, formerly consisting mainly of easily biodegradable materials such as leaves, feathers and ashes[19], household waste nowadays contain significant proportions of mud, bottles, plastics, paperboard, commercial and industrial detritus[20]. This household waste is part of the category of garbage commonly referred to as municipal waste, which represents all of the municipal waste that is managed by municipalities. Household waste is related to domestic activity, it includes household waste in the strict sense, garden waste and green waste.

The results on the typology give 5 types of production units. 40% of production units are type I. This type of production unit, manual is guided by an untrained and untrained leader who has acquired the land by inheritance. The area of this production unit represents 78% of the surface area of the people surveyed. These results confirm those of[17] which showed that in the Lena and Guena area (Burkina Faso), type III production units with the same characteristics as those of type I in our study are the most represented in the 62.5% of all production units studied. Type I production units could evolve towards type V. It should also be noted that those of type IV and V are likely to give or regress to types III, II or I. In addition, with life expectancy Type V production units may lose their head (over age 50), which may give rise to lower level production units, in particular Type III.

CONCLUSION

Agriculture in Bobo-Dioulasso (Burkina Faso) plays a leading role in the country's economy, but it also faces enormous difficulties that threaten it's survival. These revolve mainly around the lack of agricultural equipment and the lack of training of producers. Added to this is the precarious nature of the activity in a context of strong urbanization of the city. This study aimed to characterize production units in urban agriculture and to define the typology of these units in the Bobo-Dioulasso zone (Burkina Faso). From this study it may be noted that the characteristics of the production units studied differ from one site to another but also within the same site. It also emerges from this study that the production units studied can be divided into five types. The dominant type of production unit is the type that accounts for 78% of the areas surveyed and characterized by a level of manual equipment, guided by an untrained and untrained leader who acquired the land by inheritance. The objectives of the units differ according to the type, if the primary objective of the type I production units is to ensure their subsistence, that of the types III to IV is to release a surplus to improve their well-being (wedding, purchase of motorcycle, agricultural equipment ....). In the study area, the most vulnerable heads of production units are those of type I. To initiate their development, external support would be necessary.

REFERENCES

1. Smith, O.B., Moustier, P., Mougeot, L.J.A., Fall, A., Développement durable de l'agriculture urbaine en Afrique de l'Ouest francophone : Enjeux, concepts et méthodes, (CIRAD, CRDI.), Dakar, Ottawa, 173p (2004).
2. FAO, Rôle de la FAO dans l'agriculture urbaine, [Online] Available: http://www.fao.org/urban-agriculture/fr/. (2016).
3. Mougeot, J. L. A., Autosuffisance alimentaire dans les villes : l'agriculture urbaine dans les pays du Sud à l'ère de la

mondialisation, dans: Armer les villes contre la faim, CRDI. (2000).
4. Kaboré, S. G., Les représentations sociales du déchet dans la ville de Ouagadougou: le cas des déchets plastiques, Mémoire de Maitrise, 80p (2010).
5. Dumat, C., Xiong, T., Muhammad, S., Agriculture urbaine durable *:* opportunité pour la transition écologique, *Presses Universitaires Européennes*, Saarbrücken, DE, 82p (2016).
6. Bories O., L'agriculture en ville, Mondes Sociaux, [Online] Available : https://f.hypotheses.org/wp-content/blogs.dir/1243/.../2015/.../Lagriculture-en-ville.pd. (2015).
7. Duchemin, E., Agriculture urbaine: Aménager et nourrir la ville, Éditions *en* environnement *VertigO*, 394p (2013). [Online] Available : https://vertigo.revues.org/16513?lang=pt
8. Guiomar, P., Aubry, C., Dossier « *agricultures urbaines* », *Revue POUR*, 224, 442p (2015).
9. Madre F., Vergnes, A., Machon, N., Clergeau, P., Green roofs as habitats for wild plant species in urban landscapes: First insights from a large-scale sampling. *Landscape and Urban Planning*, **122:** 100-107 (2014).
10. Fontès, J. et Guinko, S., Carte de la végétation et de l'occupation du sol du Burkina Faso, Note explicative. Toulouse: Ministère de la coopération française (France), 53p (1995).
11. Pallo, F. J. P., Sawadogo, L., Sedogo, M. P., Asso, A., Statut de la matière organique des sols dans la zone Sud-soudanienne au Burkina-Faso. *Biotechnol. Agron. Soc. Environ*, **12(3):** 291-301 (2008).
12. Jouve, P., Quelques principes de construction de typologies d'exploitations agricoles suivant différentes situations agraires "In *Cahier de la Recherche Développement*" CIRAD, France, 39-47 (1986).
13. Kaboré, W.T., Hien, E., Zombré, P., Coulibaly, A., Houot, S. et Masse, D., Valorisation de substrats organiques divers dans l'agriculture péri-urbaine de Ouagadougou (Burkina Faso) pour l'amendement et la fertilisation des sols: acteurs et pratiques. *Biotechnol. Agron. Soc. Environ*, **15(2):** 271-286 (2011).
14. Zongo, N., Les déchets urbains solides (DUS) : quantités, modes d'utilisation agricole et effets sur les cultures maraichères et les sols urbains de la ville de Ouagadougou, Mémoire de fin de cycle d'ingénieur, Institut du Développement Rural/Université Polytechnique de Bobo-Dioulasso, Burkina Faso, 84p (2007).
15. Blanchard, M., Coulibaly, K., Bognini, S., Dugué, P., Vall, E., Diversité de la qualité des fumures organiques produites par les paysans d'Afrique de l'Ouest : quelles conséquences sur les recommandations de fumure ?. *Biotechnol. Agron. Soc. Environ*, **18(4):** 512-523 (2014).
16. Ouattara, S., Diagnostic des pratiques de valorisation agronomique de substrats organiques dans la zone urbaine et périurbaine de la ville de Bobo-Dioulasso (Burkina Faso), mémoire Institut du Développement Rural, Université Polytechnique de Bobo-Dioulasso, 53p (2014).
17. Kabore, I., Itinéraires techniques recommandés et pratiques paysannes courantes dans la zone cotonnière Ouest du Burkina Faso : cas du coton et du maïs, 81p (2014).
18. Service Propreté/ Direction des Services Techniques Municipaux (SP/DSTM), La gestion des déchets solides urbains à Bobo-Dioulasso: Etat des lieux, 15p (2016).
19. Morez, R., Du déchet urbain au maraîchage : mission d'évaluation d'une opération pilote à Ouagadougou au Burkina Faso, 68p (1987).
20. Waas, E., Valorisation des déchets organiques dans les quartiers populaires des villes africaines. Projet FNRS N°5001-038104. Module 7, développement et environnement. Programme prioritaire SKAT, 143p (1996).