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Agricultural Use of Urban Soils Used for Vegetable Production at Marcory, Abidjan

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Abstract : ***A study was undertaken in 2015 to determine the characteristics of the soil found in the vegetable garden perimeter situated in the Marcory Municipal High School, where several vegetable cultivators are farming, The objective of this study was to identify the causes of production related issues, the nature of the soils and irrigation waters that are responsible for lower output on this perimeter. Soilsalinity, temporaryhydromorphy, mixtures with the lagoon, excessive use of droppings and quality of irrigation water all contributed not only to lower outputs but also with poor quality products.***

Keywords: Soil characterization, salinization, Marcory, hydromorphy, quality of products

1. Introduction

The vegetable garden perimeter within the Marcory Municipal High School is bordered by the Ebrielagoon. This lagoon is the receptacle of waste materials and household refuse which strongly pollute this water. The closeness of the vegetable garden perimeter to the lagoon causes the problem of soil pollution, as is the case with many other cultivated areas close to Abidjan. The poorquality of these lands undermines the sanitary quality of the products. Several studies have analyzed the significance of the phenomenon. For example, in Nouakchott, Azandosessi et al., 1999; Ould Baba, 1998; N'diaye et al., 2009 showed through their study that the soils devoted to these activities are subject to pollution by the effluents of the city.In Benin, the contamination of vegetables has been traced to the quality of the soil in the vegetable garden perimeter of the community of Grand-Popoas reported by Séraphin et al. (2011).

Moreover, the apparently over-utilization of these poor lands requires intensive use of organic manure such as chicken droppings. In Côte d'Ivoire, studies have revealed metallic contamination of vegetables in areas where poultry droppings were applied (Kouassi***et al.***,2008).

In spite of all these results, which discredit this sector of the economy, thecultivators , in spite of the danger and the negative impact on the health of the population, continue to cultivate.

2. Materials and Methods

A soilpit and sampling of soil packaged in sachets and water in bottles of mineral water, were used for the study. The open pit was described *in situ*, according to the soil description sheet. Another sampling was carried out on the irrigation water used by the cultivators. Mineral water bottles have been previously rinsed with sampling water to avoid the risk of contamination. Kraft paper envelopes were used for the collection of plant samples for laboratory analysis. Visual observations were made over a year to see the condition of soils in dry seasons and in rainy seasons. The analyzes were carried out on water, soil and vegetation of Yamoussoukro. On a soilsieve, the size of the soil particles in its various fractions (sand, silt, clay) was determined according to the international Robinson pipette method, water pH by placing 20 g of soil in 5 to 10 ml of distilled water, stirring for 2 hrs, CEC with ammonium acetate, organic carbon according to the method of Walkley and Blach (Matieuand Piétan**,** 2003**).**

3. Results and Discussion

1- In situ description of the soilusing a soilpit

A soilpit (4 ° 05'15"W and 6 ° 10'21"N) wasopened on the site showing two horizons. The secondary vegetation consisted of sedges, millet plants, some banana trees and ornamental plants.

The *in situ* description gives :

* A well-drained, coherent horizon of 0 to 25 cm, of spottedbrowncoloring (10YR 4/3 to 5YR, yellowocher), with a sandy-loamy-clayey texture. It is an A_{11}Pg type horizon
* A horizon of 25 to 48 cm, poorly drained, not verycoherent, of brown to grayish to verybrown coloration (5YR 4/2 to 5YR5 / 6, ocher brown), with sandy-loamy-clayey texture. It is an A_{12}Pg type horizon

These characteristics show that it is a highly disturbed soil of the anthroposolgleyic type

At 48 cm, one reaches the level of the water table, after two months without rain. In addition, **Tables I** and **II** give the results of the laboratory analyzes.

Table 1: Pedological characteristics of the soil horizons (0-25 and 25-48 cm)

Horizons	Granulometry				O.M%		C/N	P.ass	CEC
	Silt %	**Loamy%**	**Clay %**	**pHwater**	**C**	**N**		**PPm**	(cmol.kg-1)
H1	91,00	7,50	1,50	6,50	0,66	0,07	9,43	68,00	3,20
H2	88,00	9,50	2,50	6,70	0,31	0,04	7,75	70,00	4,56

The analysis revealed silt and clay contents of less than 10 pc, suchsoils are according to the LANO standard (2008), soils with pure sandy texture (91,50 and 88,60 pc of sand), their pH ranges between 6.5 <pH≤7, they are therefore neutral (LANO, 2008). They have a low cation exchange capacity (CEC <9). The organic matter content O.M (7.3 <14), which makes them very poor in organic matter. The C / N ratio shows that mineralization is relatively fast. These soils have a Pass<0.08 and would belong to the T2 threshold defined by LANO (2008), these are non-calcium soils requiring fertilizer to enrich the soil.

Table 2: Pedological characteristic of water (pit and watering well)

		(cmol.kg-1)					
Elements	K	Ca	Mg	Fe	Mn	Cu	Zn
Watering water in vegetable garden	1,778	5,429	1,032	3,24	1,46	0,00	0,17
Water from the soil pit	3,061	5,581	2,600	4,57	1,24	0,00	0,36

Except for Mg, which has a higher concentration in the watering water, the water in the pital one contain other metallic elements. Cu is absent in both fractions of water. Ca, is the metal with the highest concentration in both fractions of water. This, could explain, its' high concentration in tomato fruits, grown on the ground.

4. Annual Diagnosis of Soil Cultivation

Annual observations revealed that the soils are hydromorphic for up to three months, rendering the soil unfit for agricultural activities. In the absence of adequate means to drain the plot, vegetable garden cultivators have to wait for the water level to fall before embarking on their activities. Moreover, crops are planted on ridges whose thalwegs remain flooded for a long time. During the dry season, on the other hand, the soils have a high salinity rate, which prevents any regrowth of the plant, regardless of the species being grown. There is then a large stripped area or taken over by weeds (Figure 1). In worst cases, we observed earlier planted crops drying up with climate changes (Figure 2). According to Condom (2000), the evaporation phenomena, which is inherent to increase in temperature will accentuate this phenomenon of salt concentration. Ghassemi et al.,(2005) estimated the cost of salinization to $ 12 billion / year. This cost they claimed will likely be double in the future, since salinization is steadily gaining ground. The phenomenonis due to the presence of salts naturally in subsurface or the use of brackish water for irrigation (Oteron and Soler, 2002).The color of the spraying water mixed up with aquatic plants suggested the poorquality of the water, stagnated in wells containing run off water or that of the water table of the lagoon (Figure 3). During the favorable period, there is a marked improvement in conditions (Figure 4)

Figure 1: Bare plots in the dry season

Figure 2: Dryingmint plant

Figure 3: Irrigation water is of a lesser quality

Figure 4: Thrivinglettuce and tomatocropsduring the rainyseason

The low concentration of K (1.778 cmol.kg-1); Ca (5.429cmol.kg-1); Mg (1,032cmol.kg-1), and metals except Mn (1.46cmol.kg-1) in watering water could be explained due to the effects of dilutions caused by rainfall. Indeed, the samples were collected at a time when it was raining abundantly. On the other hand, their relatively high concentration in the pit'swater in same order (3.061cmol.kg-1); (5.581cmol.kg-1); (2,600cmol.kg-1), highlights their

Solubility and hence their leaching to the lower horizons. In addition, pit's water rich in metal elements Fe (4.57cmol.kg-1); Zn (0.36 cmol.kg-1), showed that cultivating in the soil could be contaminated. Cu is absent in both types of water. The presence of these metals in the water of the soilp it revealed their natural presence in the soil. A study carried out in Benin revealed the presence of these heavy metals in a control soil sample free from any organic and mineral fertilizer; which would highlight the natural presence of these metals in the soil, water and in the atmosphere (Séraphin et al., 2011).

Studies by Kouassi et al. (2008), conducted in the county of Cocody, Marcory and Abobo, have shown concentrations of ETM in soils, either or not modified with manure. According to these authors, the values obtained remain below those obtained in Jos, Nigeria, and Ferrelaye, France. For Cd, Pb and Ni, the concentration value expressed in mg.Kg-1 is respectively of the order 0.47 -51 and 19.8 (Marcory), 1.72 -524.6 and 261.4 (Cocody); 1.55 -130.1 and 405.4 (Abobo, control site, without manure), 10.2 -426 and 28.6 (Jos) and 4.7 -436 and 22 (France), compared with France values which are of the order of 2 -100 and 50 mg.Kg-1.

These results confirmed the contamination of soils by these heavy metals and the probability of contamination of different crops. In addition, Club (1999) and ADEME (2003) showed that the variation in the values of these metals is linked to soil texture. Indeed, this distribution is not homogeneous between the particle size of the soil. Therefore, Cd, Zn and Ni contents are attributable to the organic matter in the sand fraction of the soils, while Co isbounded to the clay fraction. The negative charges of the clay favor an adsorption of these metals, which may increase their concentration value.

5. Conclusion

The sandy texture of soils could be explained due to the intensive use of organic and mineral fertilizers to improve crop yields. Irrigation water must be pre-treated before use. The infectious nature of cultivating soils devoted to these farming activities is well established and may lead to crop contamination, with an impact on the health of consumers. An alternative, farming method must be considered perhaps with the soil-less culture that will also resolve the soil problems.

References

[1] **ADEME** (Agence de l'Environnement et de la Maitrise de l'Energie), **2003** : Teneurs des plantes à vocation alimentaire en éléments traces suite à l'épandage de déchets organiques, synthèse d'essais agronomiques français et modélisation des transferts sol-plante, 75p.

[2] **Azandosessi A., Ould Selmane M.L., Ould Baba L., Benzeroug E.H., Cissé G., Nner M.et *al*., 1999 :**Projet de préservation de l'unique espace vert de Nouakchott : le site de Sebkba « Nouackchott El Khadra ». Document de projet, OMS, Nouackchott.

[3] **Club C., 1999** : Spéciation des métaux dans le sol, 296p.

[4] **Condom N., 2000** : Analyse et réalistion des processus hydrogéochimiques dans la salinisation des sols : Application aux sols rizicoles irrigués de l'Office du Niger. Thèse, Ecole Nationale Agronomique de Montpellier, France, 225 p.

[5] **Ghassemi F., Jakeman D.J. et Nix H.A., 1995** : Salinisation of Land and Water Ressources. University of New South Wales. Press Ltd, 24 p.

[6] **Kouassi J.K., Yves-Alain B., Ahoua E.S., Denis B., Denezon O. D., Moussa B., Fatiha Z. et Peggy M., 2008 :** Diagnostic d'une contamination par des Eléments Traces Métalliques de L'épinard (*Spinacia Oleracea*) Cultivé sur des sols Maraîchers de la ville d'Abidjan (Côte d'Ivoire) Amendés avec de la fiente de volaillepp. 471-487.

[7] **LANO, 2008** : Laboratoire Agronomique Normand, www.lano.asso.fr, consulté en février2016, 11p.

[8] **Mathieu C. et Piéltain F., 2003** : Analyse chimique des sols : méthodes choisies, édition Tec et Doc. 387p.

[9] **N'diaye A.D., Kankou M., Sarr A.D., Baidy L., 2009 :**Caractérisation physicochimique des eaux usées brutes de la ville de Nouckchott, *Rev. Ivr.Sc. Technol*, **14**, pp. 97-109

[10] **Otero N. et Soler L., 2002** : Sulphur isotopiques as traces of influence of potash mining in the Liobregat basin (NE Spain). Water research, pp 3989-4000.

[11] **Ould Baba L., 1998 :**Projet de préservation de l'unique espace vert de Nouakchott : le site de Sebkba « Nouackchott El Khadra ». Rapport, Bureau OMS, Nouackchott.

[12] **Séraphin C.A., Euloge K. A., Joel H. et Romain G., 2011** : Contamination métallique des légumes des périmètres maraîchers urbains et péri-urbain : cas de Grand- Popo au Bénin, Article, 12 p.