BloEx - Journal
Britain International of
EXACT Sciences Journal
Publish: | January - May - September |
E-ISSN: 2686-1208
P-ISSN: 2686-1216
http://biarjournal.com/index.php/bioex

# Evolution of the Soil Report Carbon / Nitrogen in Relation with the Severity of the Bunette Groove of Cassava (SBM) in Three Agrosystems of the Yakonde Set (Y2) in the Reserve of the Biosphere of Yangambi, DRC

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***Abstract:***

*The occupation of earth, dominated by the peasant fields of Obama cassava in forest zone on the Yakonde set (Y2) in Yangambi in Congolese central pan (RDC), change quickly and the forest fragmentation bound to the roving agriculture on the giblets-burnt lands became one of the processes dominating the landscape dynamics. In addition to the machete and the ax, fire remained for the agriculturists of the region an excellent means to get rid of the cut vegetation and also to lead physical and chemical modifications quickly in the superficial layers of soil. To put in evidence, the evolution of the values of the C/N report of soil in report to those of the severity of the brunette groove of cassava (SBM) that rages currently in Yangambi (CWAVE project), three agrosystèmes of the Yakonde set (Y2) have been chosen: the secondary forest (FS), the forest recrû (RF) and the grassy fallow (JH). In every in every different type of forests, an extent of 50m x 50m was there cut, arranged and without use of fire and the cuttings healthy and infected of SBM of the cassava of the Obama variety have been planted in lines simple oriented north-south in under-parcels in repeated at random two blocks. In 19 pedological pits of the experimental site, 76 pedological samples have been appropriated in two slices of soil: 0 - 20 cm and 20 - 40 cm of depth. The total organic nitrogen of soil has been measured out by the Kjeldhal method and the carbon, by the method to the bichromate of potassium by humid way and to cold weather (Kombele, 2004, Kakuni, 2020). as for the severity of SBM, she/it has been determined by observations on symptomatic leaves and without the symptoms according to the methods of Sseruwagi and al. (2005) and Mware and al. (2009). The results gotten to four months of age of Obama cassava show that the middle values of the C/N are raised more in the grassy fallow (JH) with 8,76±3,43 and a severity of the SBM of 2,7, consistent of those of the secondary forest (FS) with 7,26±3,37 the C/N and a severity of the SBM of 2,4, those of the forest recrû (RF) with 5,28±3,02 the C/N and a severity of the SBM of 2,1.*

***Keywords:***

*C/N report of soil; brunette groove; Yakonde set (Y2); reserve of the Yangambi; no incineration; biosphere*

## I. Introduction

To produce enough food in a lasting manner to meet the needs of the population in strong growth is one of the big global stakes. To satisfy this food demand in strong growth, the evaluations suggest that the production of food must double from 2050 (Kombele, 2004). The attack of this objective proves to be compromised however mainly by the reduction of the arable earths and the weak agricultural outputs as well as the negative impact of the phenomena of the climatic change (Kakuni, 2020).

The problematic of the warming up of our planet, of the climatic change and the one of the food securities and the quality of life should put the organic carbon of soils (CO) to the heart of the international conventions (Bemoux, 2011, Canfin and Staime, 2015). The stocks of carbon of the low earths (inshore, shallow and permafrost) should require a particular attention because of their wealth in CO (SCOS) bigger than the one of the high earths (Kakuni and al, 2020). many services ecosystem is, indeed, returned to the environment in general and to agriculture in particular by the CO (Kombeles, 2004, Derriens and al., 2016).

Some of these services are bound to the presence in the soil of the carbon under organic shape, others depend on the other hand of the mineralization of this one as CO2. Under these two states, the carbon fills numerous functions in soil and the global environment and it, to various points of view (FAO, 2017). Of the point of pedological view, the COT (total Organic Carbon) intervenes in the pedogenesis (Duchaufour and Souchier, 1977). Of the point of pédo-agronomic view, and especially for the tropical soils, the CO constitute the main guarantee of their fertility and their productivity (Lal, 2004, Of Moraes His/her/its and al., 2017, Kombele M, 2017).

The soils of the countries of sub-Saharan Africa present weak levels of intrinsic fertility bound to the specific natural constraints in every ecological zone (Anonymous, 2003). These weaknesses are determining factors of an insufficient production to satisfy the food needs of the populations in sub-Saharan Africa. They are known badly and are mastered currently badly by these populations so that weak outputs last. The exported mineral elements impoverish soil by the harvests of the cultures food crops and are not restored him in an adequate manner.

The use of the mineral and organic manures in farming surroundings doesn't become widespread and remain petty considering the peasant's weak spending power. The roving agriculture on the beat-burnt lands as practiced traditionally in Yangambi is today prone to numerous critiques following the ecological damages observed in this region and more especially inside the Reserve of the Biosphere of Yangambi (RBY) (Kombele, 2004; Alongo and Litucha, 2007, Motondo, 2010 and Kombele M, 2017).

**1.2 Problematic**

The roving agriculture on the giblets burnt lands stays until our days the unique agricultural shape of use of the earth in sub-Saharan Africa and especially in DRC where there are some decades, the dense forest occupied the quasi-totality of the Congolese central pan. In this practice, fire is the main instrument used by the African nomadic agriculturist in the south of the Sahara for not only to clear his/her/its sowing, but also to bring to soil the ash coming from the incineration (Kombele, 2004).

Cassava (Manihot Crantz esculenta) represents the fourth source of calories in the tropical countries where more of 700 million of people depend on some for their food security (World and al., 2013). cassava constitutes a culture of subsistence as well as a source of income at a time for about 70% of the population in Democratic Republic of Congo (RDC), classified second of the big producers of cassava in Africa and to the fifth world rank of the big producers of cassava (Mahungu and al., 2014). Thailand is the first world exporter of cassava.

The culture of cassava occupies very big surfaces always contrasted to outputs very weak in Africa tropical sub-of the Sahara. In station of research in R.D. Congo for example,

the middle output of cassava is estimated to 30t/ha according to the reports of the IITA whereas it is from 7 to 8 t/ha (Kombele, 2004) in culture farmer. The statistical data of the FAO (2000) indicate that in RD Congo, the production of the cassava roots tuberoses that was valued to 19,4 million tons in 1995 descended to 15,8 million tons in 2000. The reasons of this decrease of production and weak outputs of cassava in peasant environment are multiple.

One can mention in illustrative title the lowers of fertility of soils, the use of the degenerate varieties and the practices non effective cultural, to which are added the attacks of the devastating and illnesses that entail enormous losses of output in fields. The illnesses are part of the constraint's adults of the cassava production in Africa. They cause losses important of output in roots tuberoses and in leaves, following different stages of vegetation of the plant (Mahungu and al., 2014).

The region of Yangambi (in RD Congo) that makes the object of this survey is not saved either of the pressure present anthropogenic, the variety of Obama cassava being an exotic variety well introduced in the region of Yangambi and appreciated by the peasants of the Yangambi-Center city, but this same variety of cassava faces the viral illnesses of cassava currently as the Mosaic African of Cassava (MAM) and the Brunette Groove of cassava (CBSD).

The human activities in the forest landscapes lead some disruptions microclimatic there and pedological local important but whose knowledge are even piecemeal to these days. It is here that we situate the object of the present work that worries to study the evolution of the contents of the C/N report of soil in three types agrosystem of the Yakonde set (Y2) to Yangambi-Center: secondary forest (FS), forest recruit (RF), grassy fallow land (FH). The evolution of contents and values of these pedological parameters will be studied in relation with the one of the groove drizzles cassavas (SBM) attacking the variety of Obama cassava installed by the technique of no incineration.

The present survey tried to put in evidence the evolution between the level of infection of the brunette groove of cassava of the Obama variety and the one of the soil report carbon / nitrogens in three agrosystems, all these three agrosystems belongs in the Yakonde set (Y2) in the Reserve of the Biosphere of Yangambi, DRC.

## II. Review of Literature

### 2.1 Environment

The site of this study is located in the region of Yangambi whose Point Kilometric Zero (PK0) is 100 km west of the city of Kisangani, capital of the province of Tshopo in DR Congo. This study site is located in the Yangambi Biosphere Reserve (RBY) contained in the Yangambi region whose PK0 coordinates are 24°29' Longitude East, 0°49' Latitude North and at an altitude of 500m (From Heinzelin, quoted by Kombele, 2004).

### 2.2 Material

Her plant-test of this research is the variety of Obama cassava. She/it is introduced well in the region of Yangambi and is appreciated well by the population for his/her/its interesting properties organoleptic and the quality of his/her/its production in leaves and in tubers. She/it is chosen like plant-test in this research since she/it is threatened in the region of Yangambi by the brunette groove of cassava (SBM) on less rich soils or exhausted. Indeed, one notes that in one soil poor in organic matter, the symptoms of the SBM are marked more that on one relatively rich soil (observation made by the investigators of the WAVE).

The plant material used in this research is constituted of the symptomatic leaves and without symptoms of cassava harvested in the fields installed in not incineration in our three types of agrosystem of the Yakonde set (Y2). The harvests of these leaves have been made on 30 feet of cassava of the Obama variety.

**Soil: Yakonde set (Y2)**

The soil on which is installed the fields of Obama cassava is the one of the Yakonde set (Y2). This soil presents a big extension in the region of Yangambi and is exploited more by the fields of cassava through all his/her/its plant covers. One meets it on the tray and the top of side in the region of Yangambi (Kombele, 2004). In the pedological pits installed in the fields of Obama cassava of three agrosystem, the unsettled and no unsettled samples have been appropriated and brought to the laboratory where they have been conditioned for the analyses.

**a. Material of Land**

The materials of withdrawal of these pedological samples on land are composed of a knife, of a machete, of a spade, of a metric ribbon, of the cylinders of Koppecky, of the sachets, of the ballpoint pens and papers.

**b. Material of Laboratory**

To the laboratory, the material is constituted of a steam room, a desiccator, a mortar and a pestle, the beakers, the Erlenmeyer flasks, the stepped-up feet, of a digester, of a burette, of the Kjeldhal balls, of the sized-up balls, of a distiller Kjeldahl, etc. The reagents are: the bichromate of potassium, the sulphuric acid, the diphenylamine, the mixed catalyst, the boric acid and the salt of Mohr.

## III. Research Methods

The round through the different beaches of apparition of the soil of the Yakonde set (Y2) in Yangambi (Tray Isalowe) permitted to choose and to identify the three sites for the installation of the fields of Obama cassava. The three sites are constituted of a secondary forest (FS), of a forest recruit (RF) and of a grassy fallow (JH), all carried by the Yakonde set (Y2). once the three identified sites and chosen, an extent of 50m x 50m (2 500m2) has been delimited in every site, sown and cleaned without incinerating.

The infected and infected cuttings of the Brunette Groove of the Cassava of the Obama variety have been planted to the spacings of 1m x 1m that give us a total of 5000 feet of cassava in every occupation and the lines of plantation oriented North-South. The cuttings have been harvested in the experimental fields of the Center of Research of the INERA/Yangambi (CR/INERA-Yangambi), where the illness appeared with an elevated severity. And every experimental field of this survey had 2 repetitions.

## IV. Discussion

**4.1 Obama Cassava**

The observations and withdrawals of the leaves of this research are based on the principles stipulated according to Sseruwagi and al. (2005) on the methods of inspection of the severities of the CMD, CBSD and of the white flies on cassava in Africa. On the leaves of the

cassava plantations in field, one observes a chlorosis appearing on the secondary ribs in the first place and that affects the tertiary ribs then. The severity of the illness has been valued from an active scale of 1 to 5 (Mware and al., 2009) presents itself of the following manner:

Level 1: not of the obvious symptoms, Level 2: light symptoms on the leaves, not of lesions on the stem; Level 3: chloroses foliar, middle lesions on the stems, not of die-back; Level 4: chloroses foliar and lesions pronounced on the stem, not of die-back; Level 5: defoliation with lesions on the stem and die-back decision.

### 4.2 Soil in Place

In every repetition (block) of every field of cassava occupied by the Obama variety to the level of every agrosystem, three pedological pits have been dug and every experimental field had two repetitions. The unsettled samples have been appropriated in the slices of 0-20 and 20-40cm of depth for the analyses of the total organic carbon of soil (% COT) and of the total organic nitrogen of soil (% Nt). The total organic carbon of soil has been determined by the method of potassium bichromate by humid way and to cold weather, the total organic nitrogen has been determined by the Kjeldahl method (Kombele, 2004; Kakuni, 2020 and Kombele ATMS, 2017).

For all withdrawals of soil one had to the total 19 pedological pits (18 pits in the experimental fields and one in the primary forest) and to the total one had had 74 samples of soil of which 38 appropriated to the opening of the field (36 in the experimental fields and 2 in the primary forest) and 36 appropriated to 4 months of age of the culture.

### 4.3 Statistical Analyses

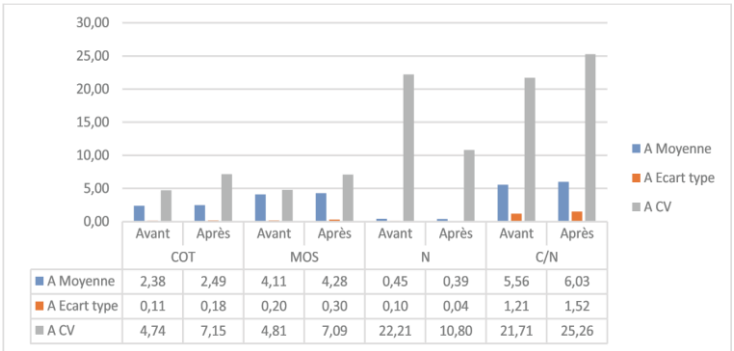
We calculated the averages of the data, their gaps types and coefficient of variance (RÉSUMÉ) of the targeted pedological parameters while putting the accent on the differences observed with the help of the ANOVA (Analysis of variance), of the test post hoc of Tukey HSD and the test of Chapiro-Wilknormality with the help of the software "Statistica" version 6.

### 4.4 Presentation of the Results and Discussions

### a. Presentation of the Results

### Secondary Forest

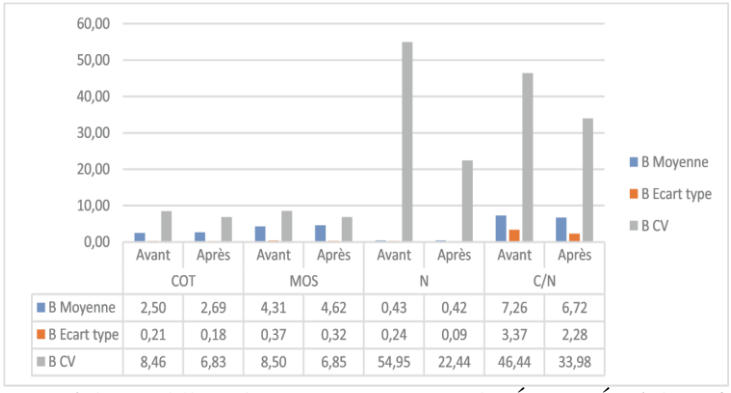
The evolution of the middle values, Gap-Types and RÉSUMÉ of the C/N report to the level of the block TO and B of the secondary forest (FS) are illustrated below by the histograms of the face 1 and 2.




| | Avant | Après | Avant | Après | Avant | Après | Avant | Après |
|---|---|---|---|---|---|---|---|---|
| | COT | | MOS | | N | | C/N | |
| A Moyenne | 2,38 | 2,49 | 4,11 | 4,28 | 0,45 | 0,39 | 5,56 | 6,03 |
| A Ecart type | 0,11 | 0,18 | 0,20 | 0,30 | 0,10 | 0,04 | 1,21 | 1,52 |
| A CV | 4,74 | 7,15 | 4,81 | 7,09 | 22,21 | 10,80 | 21,71 | 25,26 |

***Figure 1.*** *Variation of the Middle Values, Gap-Types and RÉSUMÉ of the C/N Report of the Block IN FS before the Setting in Culture in the 4th Month of Age of the Culture*

The evolution of the middle values, Gap-Types and RÉSUMÉ of the C/N report to the level of the B block of the secondary forest (FS) are illustrated below by the histograms of the face 2.




| | Avant | Après | Avant | Après | Avant | Après | Avant | Après |
|---|---|---|---|---|---|---|---|---|
| | COT | | MOS | | N | | C/N | |
| B Moyenne | 2,50 | 2,69 | 4,31 | 4,62 | 0,43 | 0,42 | 7,26 | 6,72 |
| B Ecart type | 0,21 | 0,18 | 0,37 | 0,32 | 0,24 | 0,09 | 3,37 | 2,28 |
| B CV | 8,46 | 6,83 | 8,50 | 6,85 | 54,95 | 22,44 | 46,44 | 33,98 |

***Figure 2.*** *Variation of the middle values, Gap-Types and RÉSUMÉ of the C/N report of the B block, FS before the setting in culture to the and 4th month of age of the culture*

**b. C/N report**

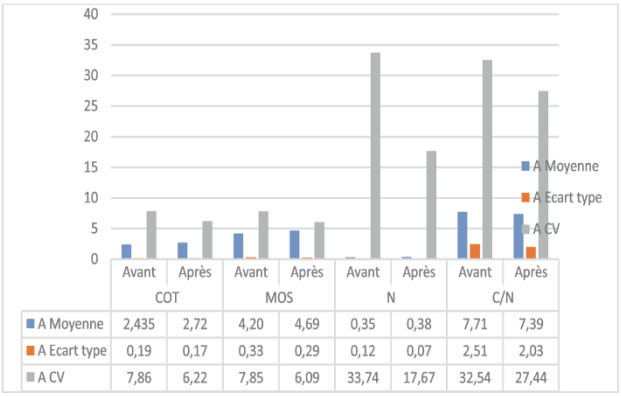
He/it clears himself/itself of the elements of the faces 1 and 2 higher than in general, the middle values and the separation-types of the C/N report in soil vary 7,26±3,37 after the culture (B block under the FS) to 5,56±1,21 before the setting in culture (block TO under the FS). The most elevated values are observed in the B block in relation to the block A, what translates a light impact of the beginning of the effects then to four months of age of the technique of the no incineration in the B block that is in place a little later beneficial for soil and the culture of the Obama cassava.

The statistical test of ANOVA to detect the influence of each of the blocks of the FS on the C/N report in soil reveals that there is not a meaningful difference ($p=0,06 > 0,05$) between the values of the C/N report observed under the two blocks (A and B) and even in the soil witness. However, these results permitted to put in evidence the potentialities of the practice of the no incineration on the organic carbon dynamics in soil. Indeed, he/it clears himself/itself here that this practice, while permitting to control the speed of decomposition of the biomass non incinerated, essentially encourage the humification that the mineralization in the blocks of soil studied.

The comparison of the dynamics of the carbon between the two blocks of withdrawal as not using the Test T of Student revealed no meaningful difference between the values of the C/N report observed before the setting in culture and in the fourth month of age of installation of the culture of Obama cassava. The variations and the gaps-types recorded by the values of this parameter before the setting in culture and in the fourth month of age are illustrated by the histograms of the blocks A and B block of the faces higher.

**c. Grassy Fallow**

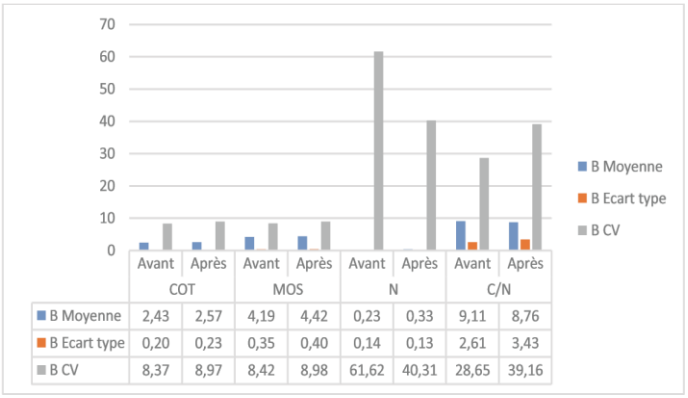
The evolution of the middle values, Gap-Types and RÉSUMÉ of the C/N report to the level of the block TO and B of the Grassy Fallow are illustrated below by the histograms of the face 3 and 4.




| | Avant COT | Après COT | Avant MOS | Après MOS | Avant N | Après N | Avant C/N | Après C/N |
|---|---|---|---|---|---|---|---|---|
| A Moyenne | 2,435 | 2,72 | 4,20 | 4,69 | 0,35 | 0,38 | 7,71 | 7,39 |
| A Ecart type | 0,19 | 0,17 | 0,33 | 0,29 | 0,12 | 0,07 | 2,51 | 2,03 |
| A CV | 7,86 | 6,22 | 7,85 | 6,09 | 33,74 | 17,67 | 32,54 | 27,44 |

***Figure 3.*** *Variations of the values of the parameters edaphic of the Grassy Fallow to the block HAS*

The evolution of the middle values, Gap-Types and RÉSUMÉ of the C/N report to the level of the B block of the Grassy Fallow (JH) are illustrated below by the histograms of the face 4.




| | Avant COT | Après COT | Avant MOS | Après MOS | Avant N | Après N | Avant C/N | Après C/N |
|---|---|---|---|---|---|---|---|---|
| B Moyenne | 2,43 | 2,57 | 4,19 | 4,42 | 0,23 | 0,33 | 9,11 | 8,76 |
| B Ecart type | 0,20 | 0,23 | 0,35 | 0,40 | 0,14 | 0,13 | 2,61 | 3,43 |
| B CV | 8,37 | 8,97 | 8,42 | 8,98 | 61,62 | 40,31 | 28,65 | 39,16 |

***Figure 4.*** *Variations of the values of the parameters edaphic of the Grassy Fallow (JH) in the B block*

**d. C/N Report of Soil**

The variations of the middle values and their gap-types of the C/N report of soil in the different blocks of the grassy fallow under the influence of the culture of Obama cassava in not incineration before and in the fourth month of age of the cassava culture are represented here in the diagrams of the faces 3 and 4 high for the blocks A and B.

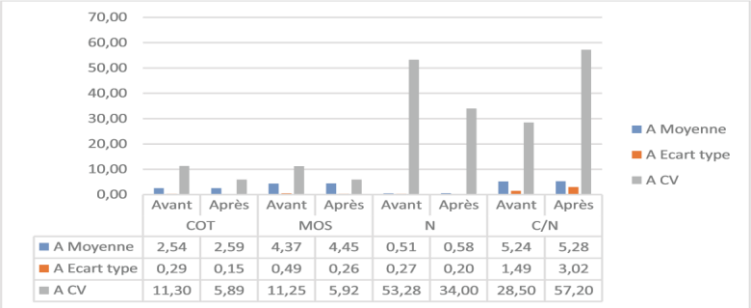
The two diagrams here high show us that the values average and the separation-types of the C/N report in soil vary from 7,71±2,51 to 9,11±2,61 before the setting in culture of cassava while using the cuttings infected in the block TO and the not infected cuttings in the B block by the system of the not incineration, whereas au fourth month of age has a regression of the values average and the separation-types that vary from 7,39 ±2,03 to 8,76 ±3,43. The most elevated values are observed in the B block in relation to the block TO, what translates a light effect of accumulation of the MOS then in every block, light beneficial effect that goes while becoming more pronounced with the progression of the decomposition of the plant biomass non incinerated in every block under this occupation of soil.

The statistical test of ANOVA to detect the influence of each of the blocks of this grassy fallow on the C/N report in soil reveals that there are not any meaningful differences (p=0,06> 0,05) between the values of the C/N report observed under the two blocks and even in the soil witness. The comparison of the dynamics of the carbon between the two

blocks of withdrawal as not using the Test T of Student revealed no meaningful difference between the values of the C/N report observed before the setting in culture and in the fourth month of age of installation of the culture of Obama cassava.

**e. Recruit Forester (RF)**

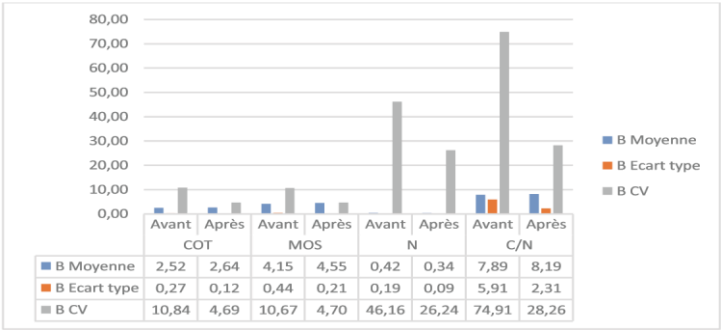
The evolution of the middle values, Gap-Types and RÉSUMÉ of the C/N report to the level of the block TO and B of the Recruit Forester (RF) are illustrated by the histograms of the face 5 and 6 following:




| | Avant COT | Après COT | Avant MOS | Après MOS | Avant N | Après N | Avant C/N | Après C/N |
|---|---|---|---|---|---|---|---|---|
| A Moyenne | 2,54 | 2,59 | 4,37 | 4,45 | 0,51 | 0,58 | 5,24 | 5,28 |
| A Ecart type | 0,29 | 0,15 | 0,49 | 0,26 | 0,27 | 0,20 | 1,49 | 3,02 |
| A CV | 11,30 | 5,89 | 11,25 | 5,92 | 53,28 | 34,00 | 28,50 | 57,20 |

***Figure 5.*** *Variations of the Values of the Parameters Edaphic of the Recruit Forester (RF) to the block A*

The evolution of the middle values, Gap-Types and RÉSUMÉ of the C/N report to the level of the B block of the Recruit Forester (JH) are illustrated below by the histograms of the face 6.




| | Avant COT | Après COT | Avant MOS | Après MOS | Avant N | Après N | Avant C/N | Après C/N |
|---|---|---|---|---|---|---|---|---|
| B Moyenne | 2,52 | 2,64 | 4,15 | 4,55 | 0,42 | 0,34 | 7,89 | 8,19 |
| B Ecart type | 0,27 | 0,12 | 0,44 | 0,21 | 0,19 | 0,09 | 5,91 | 2,31 |
| B CV | 10,84 | 4,69 | 10,67 | 4,70 | 46,16 | 26,24 | 74,91 | 28,26 |

***Figure 6.*** *Variations of the Values of the Parameters Edaphic of the Recruit Forester (RF) in the B Block*

**f. The Soil C/N Report**

The means and their standard deviations of the results obtained on the soil C/N ratio show a numerical difference between the two blocks (A and B) under the agricultural system studied. Nevertheless, they follow an increasing pace just in the fourth month of cultivation development for both blocks. As indicated above, this explains why there is good decomposition of the underground biomass that has formed within this agrosystem in block B in the fourth month of crop development. In block B, the mean values vary from 8.19 ± 2.31 to 7.89 ±5.91, followed by those of A varying between 5.28 ±3.02 and 5.24 ±1.49.

The Chapiro-Wilknormality test indicated a no-significant deviation from a normal distribution of the data (i.e. Homoscedasticity) (W=1.6472; p=0.1993 and W=3.6953; p=0 ,05456) for the slices studied before and after the establishment of the Obama cassava crop. The one-factor ANOVA analysis of variance showed a non-significant effect of the land cover factor on the MOS content ($p > 0.05$).

**4.5 Phytopathological Results**

**a. Severity of Cassava Brown Streak Disease (SBM)**

Regarding the severity of cassava brown streak disease (SBM), good progression of level 3 symptoms was observed on the leaves. However, no lesions on the stem were observed in the three experimental fields. In addition, Muwo (2011) observed a rating of 3 in his studies on the Batéké plateau in the city-province of Kinshasa in the Democratic Republic of Congo, a rating higher than that observed by Kilokota (2017) in the Territory of Isangi in the province of Tshopo.

According to Sommeryns (1976), the relatively high values of the severity levels are partly explained by the fact that the appearance of symptoms is the result of the interaction of the plant, the virus and the environmental conditions. The same author points out that the severity of the symptoms and the way in which they spread (systematic or local character) can be strongly modified by the temperature of the ambient air in which the plants are found once infected. In addition, Alimasi (2011) adds that the symptoms due to viruses in plants can vary and take on different appearances depending on the environmental conditions. It should be noted that farmers, due to lack of information and availability of healthy propagating materials, use disease-infected cassava cuttings for new plantations.

The severity of the cassava brown streak disease on the 10 infected plants of each field by agrosystem according to the SBM scale (1-5) is illustrated in Figure 7 below.

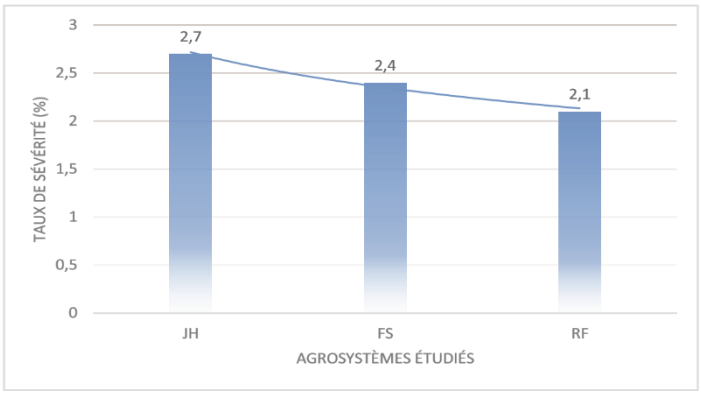



***Figure 7.*** *Variations of the middle values of the severity of the SBM in the fields of Obama cassava of the three agrosystem (1 = grassy fallow; 2 = recruit forester; 3 = secondary forest)*

He/it is above evident from the face 6 that the most elevated level of the severity of the brunette groove of cassava is the level 3 and biggest part of this severity 3 level is observed in the part grassy fallow (JH) and the most elevated average in these three types of agrosystem always observed itself in the JH to a middle level of severity 2,7 follow-up of the secondary forest (FS) with as average of severity 2,4 and the weakest middle value is observed in the forest recruit(RF) with as middle value of 2,1. One will keep that Bangambingo (2017), in his/her/its epidemiological studies achieved on the culture of cassava in the Province of the Ituri observed the opposite results (1,86); these ratings have been recorded at all plantations of cassava whatever is their age. Otherwise, nothing that in the city of Bunia, the studies of Alimasi (2011) show that the degrees of severity were from 2 to 3. However, the studies of World and al. (2013) in the city of Yangambi revealed a severity of 1 to 2.

### 4.6 Discussions

**Agropedological parameters**

The carbon contained in soil organic matter represents the majority of terrestrial carbon. It is the main indicator of soil quality for the physical, chemical and biological properties of the organic matter that contains it. Soil organic matter constitutes a real or potential reservoir (depending on the saturation rate) of nutrients in the soil by forming chelates there.

Organic matter is capable of fixing and inhibiting undesirable compounds (pesticides, xenobiotics) or traces of acidifying mineral elements (Al, Fe, Mn) (Robert, 1996). From a chemical point of view, the mineralization of soil organic matter releases fertilizing elements (such as N, S and P) which are associated with carbon in organic compounds. The recycling of these nutrients (N, P and S) by the gradual decomposition of non-incinerated plant residues is the main factor of sustainability in extensive agriculture (MayuniTokura et al., 2002). The M.O.S content of soils or C.O.T is determined on a soil sample which passes through a sieve with 2mm mesh and which brings together a set of very varied components.

In the samples of soil considered, the heterogeneity of the material and the interactions between the physical, chemical and biologic processes that take place in soil permit the fluctuation of the turnover of the different components of the organic matter. The reserve of the soil nitrogen is in very big part under a shape organic unassimilable by the plants (except the NH+ ion) either within the cool organic matter, either as the 39 compounds humics. However, the shape directly assimilated by the plants is mineral. He/it is therefore necessary that the organic nitrogen is mineralized to be assimilated by the roots of the plants in soil.

The nitrogenous nutrition of the plants is therefore in narrow relation with the speed of the nitrogen mineralization contained in the organic matter. The decomposition of the organic matter frees nitrogen stocked under organic shape and constitute one of the processes by which soil can become richer in nitrogen. During these processes, the organic matters lose advantage of the carbon that the nitrogen of which an important part is incorporated in the molecules of humus.

The C/N report of the set of the horizons humus translates a fast evolution of the plant matter at a time fallen to soil, therefore a fast return of the nourishing elements to soil and good possibilities of nitrogenous food by the plants. The values of the C/N report observed in this research oscillate in general around the value 9,11 before the setting in culture of cassava in the grassy fallow (JH). This stage, the evolution of the values of the other parameters (carbon and nitrogen organic total of soil), values to leave of which are determined those of the C/N report, is only to the beginning.

He/it is question that the observations continue themselves on several agricultural countries (seasons cultural) to judge the impact positive of the agricultural practice of the no incineration on the capture of the carbon (Obama for example) and his/her/its storage in soil and, by ricochet, on the improvement of the physical-chemical properties of the soils ferralitic in the region of Yangambi in particular and in the Congolese central pan in general.

## V. Conclusions

Our work has set as its main objective the determination of the evolution of the values of the C/N ratio of the soil in relation to that of the brown streak of cassava (SBM) in three

Obama cassava fields installed by the technique of non- incineration in three agrosystems of the Yakonde series (Y2) in the Yangambi Biosphere Reserve, DR Congo.

In the process of combating climate change and food insecurity in developing countries, certain cultural practices that capture carbon and store it in agricultural soils offer some of the most promising options for early action, efficient and cost effective (FAO, 2009).

The ultimate goal of this research was to seek to highlight the ecological role of cassava cultivation on the impact of cassava brown streak (SBM) installed by the technique of non-incineration of cut biomass on the management organic carbon stock in agricultural soil.

Three types of ecological agrosystems of the Yakonde series (Y2) are identified in Yangambi-center, namely grassy fallow (JH), forest regrowth (RF) and secondary forest (FS) and enhanced by the practice of the non-incineration of the cut biomass. They are adjacent to a primary forest taken as a reference (witness T0) and located at Plateau Isalowe, IFA headquarters in Yangambi-center.

Thus, in each ecological agrosystem, a space of 50m x 50m was delimited, planted and subdivided into two blocks A and B. In each sub-plot of each block, 3 soil pits were dug there and where 72 soil samples were collected. were taken (including 36 before cultivation and 36 others at four months of age of the cassava crop) in the slices of 0 - 20 and 20 - 40cm deep and then each block A of our fields was installed infected cuttings of the Obama variety.

The results of the laboratory analyze showed the following trends

- The highest value of the C/N ratio is at the level of the grassy fallow (JH) in block B with an average value of 9.11±2.61 before cassava cultivation and 8.76± 3.43 in the fourth month of culture, the lowest average value being recorded in block B of forest regrowth (RF) with an average value of 5.24±1.49 before cultivation and 5.28 ±3.02 at the fourth month of age of the cassava crop on the surface compared to the primary forest taken as a reference.

Thus, the only highest average value of the C/N ratio remains that of the grassy fallow (JH) in block B before cultivation (9.11±2.61 cited above). Nevertheless, in general, the average values of the C/N ratio decrease with depth in all the land uses studied.

By comparing the evolution of the values of the C/N ratio to that of the severity of the SBM, we note that the evolution of the severity of the SBM depends on the fertility of the soil in place. Indeed, higher values of the C/N ratio correspond to higher values of the severity of cassava brown streak disease (SBM). The grassy fallow (JH) presents a high severity of SBM (2.7) and the highest value of the C/N ratio (9.11±2.61); the secondary forest (FS) has an average severity of 2.4 compared to the other agrosystems and also an average fertility (C/N of 7.26±2.51); forest regrowth (RF) has lower SBM severity (2.1) and lower soil fertility (C/N of 5.24±1.49).

The severity of SBM is moderate on Obama cassava in the three agrosystems studied, which confirms the first hypothesis of this work. The values of the C/N ratio are generally low compared to those of the control, which invalidates the second hypothesis of this work.

In addition, and in view of these results of the agropedological parameters, non-incineration seems the most appropriate mode of soil reclamation with a view to the sustainable management of the stock of organic carbon in the agrosystems of the tropics in general and to the Yangambi-center region in particular.

To be more complete, this study needs another research path, that of evaluating the multidisciplinarity between the improvement of soil carbon stocks and the dynamics of soil chemical, physical and biological fertility as well as its impact. on agricultural production on the one hand and on the other hand, to expand the range of crops to assess the potential in order to increase the alternatives in the process of adaptation and climate mitigation and food security in the areas the most vulnerable as are the tropical regions.

Finally, with regard to the phytopathological part, it emerges from these results that the improved varieties (exotic) as well as the local varieties are the object of attack by the Brown Striae of cassava and this proves sufficiently that the varieties encountered do not have total resistance to this cassava brown streak disease (SBM). This may be true, as work on breeding for the induction of resistance against brown streak disease is being undertaken in high-altitude countries of East Africa where the disease is known to be endemic (Storey, 1936).

And in our country, the focus is much more on African Cassava Mosaic (AMM) than on Cassava Brown Streak Disease (SBM). For this study, the high mean value of severity is observed in the grassy fallow (JH) with an average of 2.7, followed by that of the secondary forest (FS) with the mean value of 2.4 and the mean value the lowest remains that of forest regrowth (RF) with an average of 2.1 compared to other agrosystems.

Since cassava brown streak disease (SBM) is an emerging disease in the DRC, its presence deserves special attention. There is not enough information to identify with certainty its impact on cassava crops in the different agro-ecological zones where cassava is grown. At the present time, farmers putting phytosanitation techniques into practice will make it possible to combat this disease in the medium term.

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