
Evaluation of the use of fertilizers in the territories of Aru, Djugu and Irumu (Ituri); of Gemena (Sud-ubangi); Kabongo (haut-lomami) and of Mbanza-ngungu (kongo-central) in the Democratic Republic of Congo

Patrice RUHIGWA Baguma^{a,1}, Blaise ALIANGO Uvon^b, Platini BILONGO Ngama^b and Abel MUGENYI Kagoro^c, Richard RISASI Etutu Lipaso^d

^aDean of the Domain of Agricultural Sciences and Environment, University of Bunia, P.O. Box 292, Democratic Republic of Congo

^bAssistant Lecturer, Domain of Agricultural Sciences and Environment, University of Bunia, P.O. Box 292, Democratic Republic of Congo

^cLecturer, Domain of Agricultural Sciences and Environment, University of Bunia, P.O. Box 292, Democratic Republic of Congo

^dProfessor, Domain of Agricultural Sciences and Environment, Pedagogic National University, P.O.Box 8815 Kinshasa Binza, Democratic Republic of Congo; General Academic Secretary

Abstract

Surveys were carried out in 2015, 2016, 2017 and in 2019 in the territories of Aru, Djugu and Irumu; of Gemena, Kabongo and Mbanza - Ngungu; respectively in the provinces of Ituri, Sud-Ubangi, Haut-Lomami and Kongo-Central in DR Congo. The aim was to evaluate the level of the use of fertilizers in these territories and also to appreciate the evolution of the modernization of Congolese agriculture. The use of fertilizers in DR Congo constitutes a problem given the lack of reliable statistics. In order to apprehend their importance in Congolese agriculture, we have evaluated the level of their use in the above mentioned territories. To achieve this objective, surveys implicating 561 cooperating and accessible peasant farmers selected in these administrative entities were conducted. The results showed that a small percentage of Congolese peasant farmers are using chemical fertilizers as observed in Aru (9.2%) and Mbanza-Ngungu (25,0%). The temperate climate prevailing in the territory of Mbanza-Ngungu allowing the growing of temperate crops and the proximity of the territory of Aru to the Ugandan border through which many manufactured products pass, may justify, although timid, the use of chemical fertilizers in these regions. However; 38.8% of the surveyed farmers use the organic fertilizers made up with different organic materials. Their rate of use is particularly high in Kabongo territory in Haut-Lomami followed by Gemena territory in Sud-Ubangi. The usual practices of the peasants farmers (case of Kabongo territory) and the abundant source of plant materials due to the presence of equatorial forest (case of Gemena territory), probably justify the importance given to their use in these areas. The general trend is that a small percentage of Congolese peasant farmers (5.7%) are using inorganic fertilizers. Although some of them (38,8%) do use the organic fertilizers, the majority (55,5%) however do not apply any type of fertilizers in their farms. The use of chemical fertilizers has therefore not yet reached

a threshold that can help to boost Congolese agriculture and promote the enormous potential of its agroecosystems. That is why the country is still importing its basic foodstuffs. Efforts must be made within the framework of the agricultural policy in order to demonstrate the benefits of agricultural inputs and particularly those of fertilizers for Congolese agriculture which represents an important development potential of the DR Congo. However, an assessment of the quality and quantity of fertilizers according to the needs of the crops grown in the study areas is recommended. Also, the use of seeds with high productive potential that can enhance the use of fertilizers leading to high yields and which can generate a satisfactory income for farmers can encourage their use.

Keywords: Evaluation, fertilizers, level, rate, use

Résumé

Des enquêtes ont été réalisées en 2015, 2016, 2017 et en 2019 dans les territoires d'Aru, Djugu et Irumu ; de Gemena, Kabongo et Mbanza - Ngungu ; respectivement dans les provinces de l'Ituri, du Sud Ubangi, du Haut Lomami et du Kongo-Central. L'objectif était d'évaluer le niveau d'utilisation des engrais dans ces territoires et aussi d'apprécier l'évolution de la modernisation de l'agriculture congolaise. L'utilisation des engrais en RD Congo constitue un problème compte tenu de manque de statistiques fiables. Afin d'appréhender leur importance dans l'agriculture congolaise, nous avons évalué le niveau de leur utilisation dans les territoires précités. Pour atteindre cet objectif, des enquêtes impliquant 561 coopérants et accessibles paysans de ces entités administratives ont été menées. Les résultats ont montré qu'un faible pourcentage de paysans congolais utilise des engrais chimiques comme observé à Aru (9,2%) et Mbanza-Ngungu (25,0%). Le climat tempéré qui prévaut en territoire de Mbanza-Ngungu permettant les cultures tempérées et la proximité du territoire d'Aru avec la frontière ougandaise par laquelle transitent de nombreux produits manufacturés, peuvent justifier, bien que timidement, l'utilisation d'engrais chimiques dans ces milieux. Cependant; 38,8% des agriculteurs enquêtés utilisent des engrais organiques composés de différents matériaux organiques. Le taux de leur utilisation est particulièrement élevé en territoire de Kabongo dans le Haut-Lomami, suivi du territoire de Gemena dans le Sud-Ubangi. Les pratiques habituelles des paysans agriculteurs (cas du territoire de Kabongo) et la source abondante de matériel végétal due à la présence de la forêt équatoriale (cas du territoire de Gemena), justifient probablement l'importance accordée à leur utilisation dans ces contrées. La tendance générale est qu'un faible pourcentage de paysans congolais (5,7%) utilise des engrais chimiques. Bien que certains d'entre eux (38,8%) font usage des engrais organiques, la majorité (55,5%) cependant n'applique aucun type d'engrais dans leurs champs. L'utilisation des engrais n'a pas encore atteint un seuil qui puisse contribuer à dynamiser l'agriculture congolaise et valoriser l'énorme potentiel de ses agroécosystèmes. C'est pourquoi le pays importe encore ses denrées alimentaires de base. Des efforts doivent être faits dans le cadre de la politique agricole afin de démontrer les avantages des intrants agricoles et particulièrement ceux des engrais pour l'agriculture congolaise qui représente un important potentiel de développement de la RD Congo. Cependant, une évaluation de la qualité et de la quantité des engrais en fonction des besoins des cultures pratiquées dans les zones d'étude est recommandée. Aussi, l'utilisation de semences à haut potentiel productif qui

peuvent favoriser l'utilisation des engrais conduisant à des rendements élevés et qui peuvent générer un revenu satisfaisant pour les agriculteurs peuvent encourager leur utilisation.

Mots-clés : Evaluation, engrais, niveau, taux, utilisation

INTRODUCTION

The main role of the agricultural sector is to provide to the society, in sufficient quantity and quality, the basic food products required for a balanced diet (OGUET, 1989). Main employer in the world and livelihood of 40% of the current world population, the agricultural sector has been recognized since the adoption of the Sustainable Development Goals (SDGs) by the United Nations in 2015, as a central element of social and economic progress (SPORE.CTA.INT (2019)).

The agriculture therefore should be the basis of both African and Congolese economies. Indeed, the agricultural potential of the DR Congo is unanimously recognized as being considerable: the country has cultivable areas estimated at some 75 million hectares of which less than 10 million hectares are exploited (TECSULT-AECOM, 2009; LEBAILLY *et al.*, 2014).

This land availability and the enormous water resources available to the country with the Congo River basin maintain the hope of better food self-sufficiency so required by the Congolese (PEEMANS, 2014).

CRUZ *et al.* (2019) believe, however, that one of the main problems to be solved is to modernize the agri-food system so that it is competitive in national, regional and global markets while offering to young population opportunities for entrepreneurship, improving their living conditions and finding a job. This modernization however requires the use of techniques, inputs, but also equipment adapted to the needs of the sector.

Fertilizers are one of the essential elements in improving the productivity of agricultural land, which is often the victim of overexploitation linked to the sedentary way of life led by almost all the agricultural population scattered around the world. Fertilizers provide the crops with the nutrients they need. They increase production and improve the quality of food crops. With fertilizers, you can improve the fertility of poor soils, which are constantly degraded

by overuse. All these elements ensure better well-being of the village, the community and the nation (FAO, IFA and IMPHOS; 2003).

These organizations point out that before thinking about applying chemical fertilizers, it is advisable to use all available sources of nutrients: cow dung, pig manure, chicken manure, crop residues, straws and all other organic materials.

The organic fertilizers improve the soil properties, while mineral fertilizers provide plants with the nutrients they need. Thus, organic manure alone is not enough and often it is not available in large quantities to ensure the level of agricultural production expected by the farmer (FAO, IFA and IMPHOS, 2003).

With a growing Congolese population and to avoid malnutrition and famine that threaten the country, farmers should resort to the fertilizers to maintain soil fertility in order to improve crop yields and quality.

The use of green manures can improve soil fertility for crops, apart from other advantages of using plant materials, which can be among other things, the improvement of the sanitary condition of the soil and crops, the stimulation of life in the soil, the improvement and the stabilization of the soil structure, the production of organic matter, and also as sources of nutrients (DUSTIN, 2013).

But, to compensate for the large amounts of nutrients exported by crops and to improve crop growth and yields and quality, the supply of fertilizers is required. However, little information is available regarding the use of fertilizers in DR Congo.

Taking into account this observation, it was necessary to evaluate the level of the use of fertilizers in the Congolese agriculture, in order to appreciate the trend of the modernization of this sector.

STUDY AREAS AND METHODS

Study areas

The DR Congo is administratively organized into 25 provinces and the city of Kinshasa which has the status of a province. The territories of Aru, Djugu and Irumu; of Gemena, Kabongo and Mbanza-Ngungu, located respectively in Ituri, Sud-Ubangi, Haut-Lomami and Kongo-Central provinces consisted of the areas of the study.

The province of Ituri is situated in the extreme northeast of DR Congo, on the western slope of Lake Albert and has five territories including the territories of Aru, Djugu and Irumu (OMASOMBO, 2021).

The territory of Aru, with an area of 6,749 km², is situated in the north of the Ituri province and bordered in the north by the Republic of South Sudan, in the east by the Republic of Uganda, in the south by the territories of Djugu and Mahagi in Ituri province and in the west by the territories of Faradje and Watsa in Haut-Uele province.

Its geographic coordinates are 30° 10' and 30° 90' of East longitude and 2° 40' and 3° 65' of North latitude. The average altitude is 1,300 meters above sea level.

The territory experiences a more or less mild type of subtropical climate, with alternating dry and rainy seasons and an average annual temperature of 25 ° C.

Its vegetation is a steppe savannah in the northeast, grassy in the centre and in the south, and wooded in the west with some forest galleries. There is also a small dense equatorial-type forest in the south-west.

The soils are clay-sandy soils and sandy-clay soils. The population practices agriculture and livestock farming.

The territory of Djugu has an area of 8,740 km². It is bordered in the north by the territories of Aru and Mahagi, in the south by the territories of Irumu and Mambasa, in the west by the territory of Watsa in Haut-Uélé province and in the east by Lake Albert. Its geographic coordinates are 1° 56' North latitude and 30° 30' East longitude. Its average altitude is 1,674 m and its climate is tropical humid with alternating dry and wet seasons. The average annual temperature is 18° C. The soils are very fertile sandy-clays. The agriculture and the livestock farming constitute the main socio-economic activities.

Covering an area of 8,183 km² and located in the south-east of the Ituri province, the territory of Irumu is limited in the East by the River Semliki and the Lake Albert, in the west by

the territory of Mambasa, in the north by the territory of Djugu and in the south by the territory of Beni in the North Kivu province. Its geographic coordinates are 1° 0'0'' - 1° 40'0'' North latitudes and 29° 20'0'' – 30° 0'00'' East longitudes. It has a humid tropical climate with alternating rainy and dry seasons. Its average altitude is 935 m and its clay-sandy soils, fertile and rich in humus, favour agricultural activities. Agriculture constitutes the main activity, occupying 80% of the population, while animal rearing occupies 12%. The east and the center are occupied by the savannah with the forest in the south and the west.

The territory of Gemena, covering a total area of 11,488 km², is one of the four territories that make up the province of Sud-Ubangi. It is situated in the north-western part of the former Equateur province and bordered by the territory of Bosobolo in the north, of Budjala in the east and the territories of Kungu and Libenge in the west. It is located between 2 ° and 4 ° North latitude and 18 ° and 20 ° East longitude with an average altitude of 400 m.

The climate is equatorial, but of the hot tropical type with little annual variation in temperature. The average temperature is 25 ° C.

There are two seasons: one rainy and the other dry. Its vegetation consists of the very dense gallery forest and a savannah dominated by *Imperata cylindrica*. The soils are sandy-clays which are fertile.

The agriculture is the main activity of the population. Food crops (maize; cassava and groundnuts) and a few cash crops (cocoa, coffee and oil palm) constitute the main crops.

The territory of Kabongo, with an area of 20,621 km², is one of the 9 territories that make up the province of Haut-Lomami in the north of Katanga. It is bordered by the territories of Lubao and Kabalo in the north, of Kamina and Bukama in the south, of Manono and Malemba Nkulu in the east and of Kaniama, Ngandajika and Kabinda in the west.

The humid tropical climate experienced by the Kabongo territory is characterized by an alternation of two seasons: the dry season and the rainy season. The temperature varies

between 22 °C and 30° C but it even goes beyond due to the effects of disruption of ecosystems. The deforestation practiced by the population reinforces this alarming situation.

The territory of Kabongo is dominated by savannas, gallery forests as well as open forests shading streams. There are four types of soils: clay soils, sandy soils, sandy clay soils and sandy clay soils. The larger area is covered by sandy soils and a small part is characterized by clay soils. A part from fishing, hunting and animals rearing, the agriculture remains the main activity of the population.

Its geographic coordinates are 6° 20'0'' - 8° 0'0'' of South latitudes and 24° 38'0'' – 26° 25'0'' East longitudes with an average altitude of 1,027 m.

The Kongo - Central province has ten territories including that of Mbanza-Ngungu. The territory of Mbanza-Ngungu, with an area of 8,460 km², is bordered in the north by the Congo River and the territory of Luozi, in the south by the Republic of Angola, in the east by the Inkisi river and the territory of Madimba and in the west by the territory of Songololo. The geographic coordinates are 5°0'0'' - 5°40'0'' of South latitudes and 14° 20'0'' - 15°20'0'' of Est longitudes.

The territory enjoys a humid tropical climate with two seasons: the rainy season and the dry season. The temperature varies between 28 ° C and 33 ° C during the rainy season and between 14° C and 29 ° C during the dry season. Its altitude varies between 780 m and 785 m and has a cool and humid climate which explains the freshness which reigns there and the practice of some temperate crops. Its rich soils, predominantly clayey, are a major asset that makes agriculture the main activity of the territory (CONGO-AUTREMENT, 2019).

The study areas are represented by the Figure 1.

Territories of Aru, Djugu, Gemena, Irumu, Kabongo and Mbanza-Ngungu

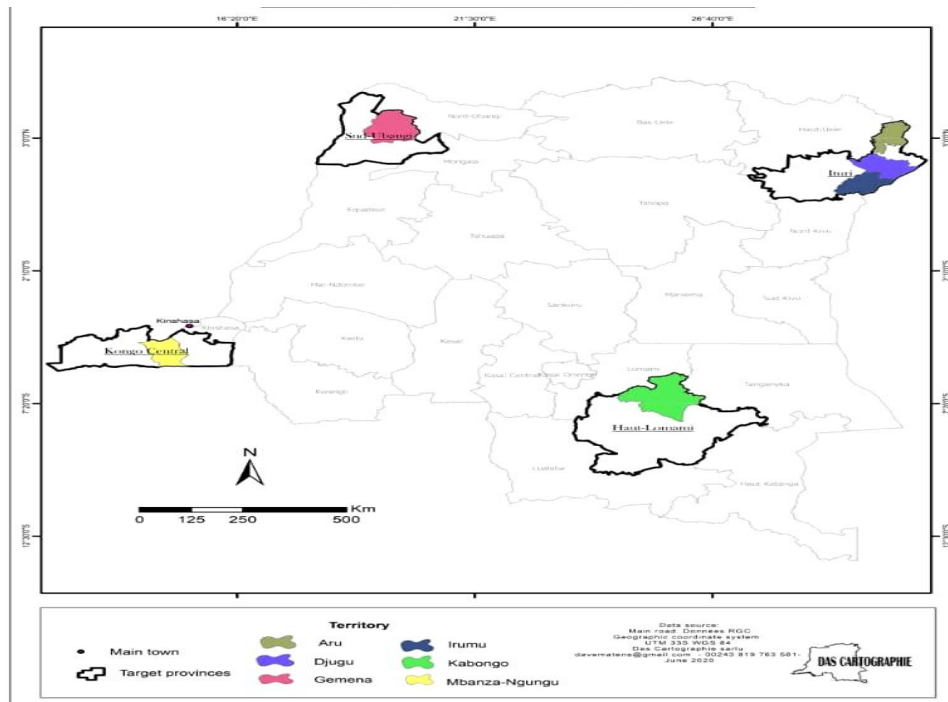


Figure 1. Map of the study areas

Material

As material, we used the questionnaire of the pre-survey and that of the survey. This questionnaire was of the closed type.

Methods

To conduct the study, we used descriptive and documentary methods in combination with the techniques of direct observation, interview and questionnaire. These methods and techniques were used to describe the study areas and to collect primary data on the level of use of fertilizers in the selected areas. The sample of the study consisted of the peasant farmers of the territories of Aru, Djugu and Irumu in Ituri; of Gemena in Sud-Ubangi, of Kabongo in Haut-Lomami and of Mbanza-Ngungu in Kongo-Central. A survey by a reasoned choice was carried out by retaining in each selected province, one or a few territories, depending on human and financial resources available, and where agriculture is the main activity of the population. In total,

561 cooperating and accessible farmers in the selected territories were subjected to the questions in line with the methods and techniques mentioned above.

Data analysis

The data of the surveys were analyzed using the technique of content analysis. This technique is often used when it comes to exploit a number of data such as responses to a questionnaire, interviews, etc (VALETTE, 2007). The data of the evaluated parameters were expressed in percentages in a standard form of base equal to 100 and presented in the form of graphs to facilitate relative comparisons (KOTHARI, 1985).

RESULTS AND DISCUSSION

Results

The data of the use of fertilizers in the surveyed territories of the DR Congo are presented in figure 2 to 6.

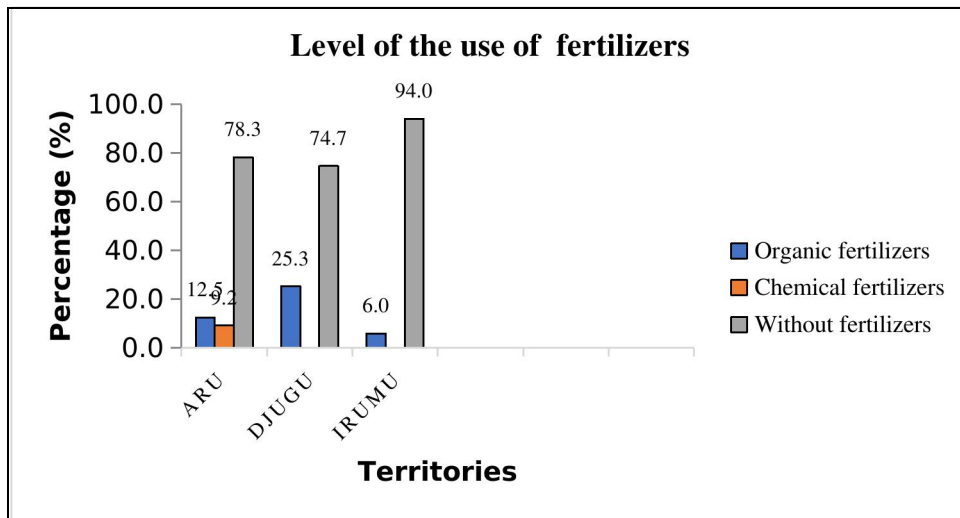


Figure 2. Level of the use of fertilizers in Ituri province

The indicates that most of the farmers of the Ituri province do not use fertilizers in their cropping systems, as it can be seen for the territories of Irumu (94.0%), Aru (78.3%) and Djugu (74.7%). Organic fertilizers are used only by 25.3% of farmers in Djugu, 12.5% in Aru and 6.0% in Irumu. For the chemical fertilizers, a small percentage of Aru farmers (9.2%)

apply them in their cultivated crops, while the other two territories (Djugu and Irumu) do not use them.

In view of these results, the general tendency is that the majority of Ituri farmers do not or poorly use fertilizers, either chemical or organic. The results can be summarized in decreasing order as follows: chemical fertilizers < organic fertilizers < without fertilizers.

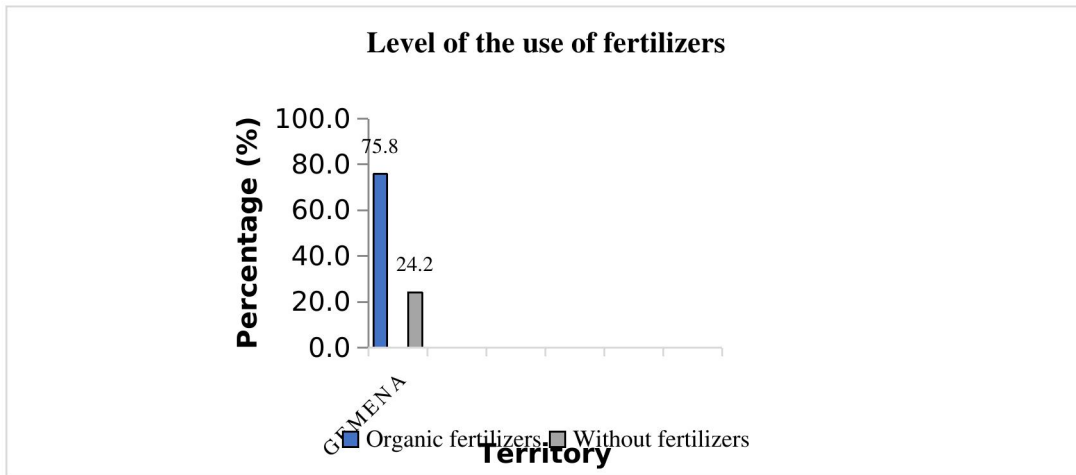


Figure 3. Level of the use of fertilizers in the territory of Gemena in Sud-Ubangi province

It emerges from the results in figure 3 that 75.8% of farmers in the territory of Gemena apply organic fertilizers in their farms while the remaining 24.2% do not use fertilizers. The use of chemical fertilizers was not observed among the respondents.

These results can, in decreasing way, be summarized as follows: without fertilizers < organic fertilizers.

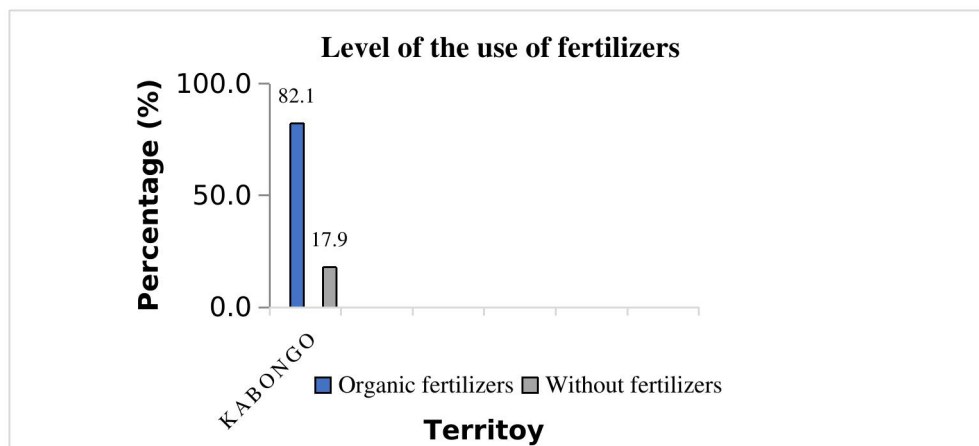


Figure 4. Level of the use of fertilizers in the territory of Kabongo in Haut-Lomami province

The results of figure 4 show that 82.1% of farmers in the Kabongo territory in Haut-Lomami province use organic fertilizers in their farming activities against 17.9% who do not apply any fertilizer in their farms to supply nutrients to the crops.

As for the territory of Gemena in Sud-Ubangi, the results of the use of fertilizers in this area can be presented in a decreasing way in this order: without fertilizers <organic fertilizers.

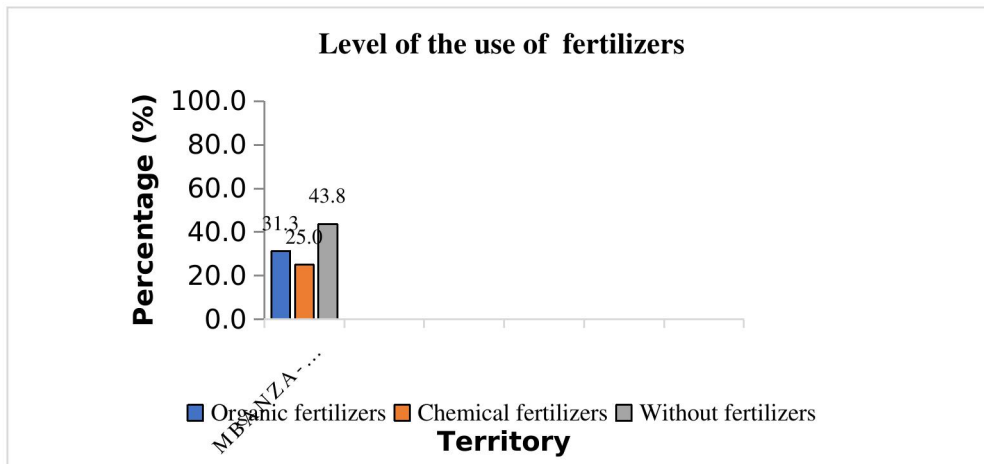


Figure 5. Level of the use of fertilizers in the territory of Mbanza-Ngungu in Kongo-Central

The results in figure 5 indicate that in the territory of Mbanza-Ngungu, 43.8% of the interviewed farmers do not use any fertilizer, while 31.3% apply organic fertilizers and 25.0% others chemical fertilizers in their farms. As for the province of Ituri, but with different percentages of fertilizer users, the results of Kongo - Central can be presented as follows: chemical fertilizers <organic fertilizers <without fertilizers.

We note from figure 2 to 5 that the Congolese agriculture remains a lesser user of fertilizers. In the 6 territories surveyed situated respectively in the North-East, North-West, South and West of DR Congo, it emerges that the peasants farmers of the Irumu territory have

the highest the record of the non-use of fertilizers (94.0%), followed by those of the territories of Aru (78.3%), Djugu (74.7%) in Ituri province; of Mbanza-Ngungu (43.8%) in Kongo-Central), of Gemena in Sud-Ubangi (24.2%) and of Kabongo (17.9%) in Haut-Lomami.

The remaining percentages of farmers surveyed in all these territories use more organic fertilizers with Kabongo territory is in the lead (82.1%), followed by those of Gemena (75.8%), Mbanza-Ngungu (31.3%), Djugu (25.3%), Aru (12.5%) and those of Irumu (6.0%).

In general, inorganic fertilizers are not used by Congolese peasant farmers, except by a small percentage in the territories of Mbanza-Ngungu (25.0%) and Aru (9.2%).

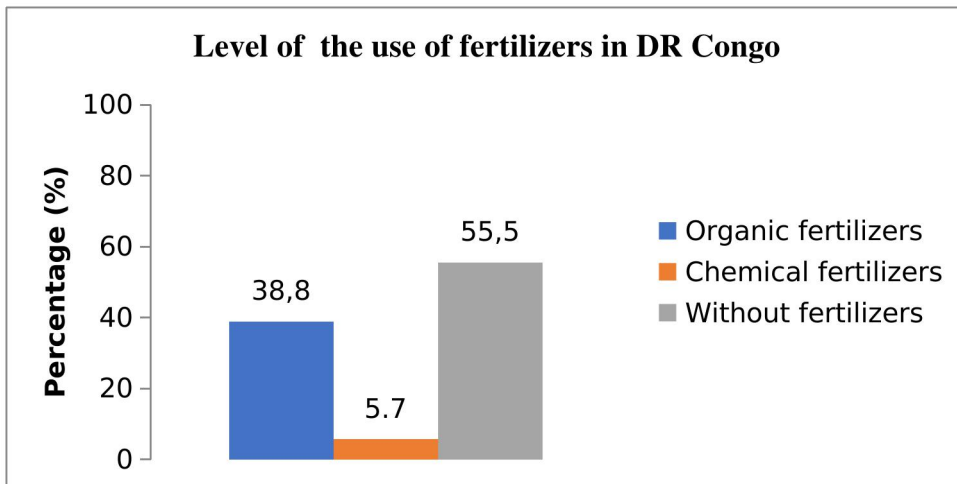


Figure 6. Global trend of the use of fertilizers in DR Congo

Based on the results of the study, the general trend of fertilizers use in DR Congo (figure 6) gives the following figures: 55.5% of the farmers do not use fertilizers, 38.8% use organic fertilizers while 5.7% use chemical fertilizers. These results can be summarized in decreasing way as follows: chemical fertilizers <organic fertilizers <without fertilizers.

Discussion

The results of the level of the use of fertilizers in DR Congo showed that more than 55.5% of farmers in the surveyed territories do not apply fertilizers, both chemical and organic to their crops. However, 38.8% of farmers in the territories covered by the study use organic

fertilizers as source of nutrients to their crops, compared with only 5.7% of them who use mineral fertilizers.

KELLY and NASEEM (2009) point out that inorganic and organic fertilizers that are used in sub-Saharan Africa (SSA), are used in very small quantities. The farmers interviewed in some territories, such as those of Kabongo (82.14%) and Gemena (75.83%) use organic fertilizers. The usual practices of peasant farmers (case of Kabongo territory) and the abundant source of plant materials due to the presence of equatorial forest (case of Gemena territory) could justify the interest given to the use of organic fertilizers in these regions.

KELLY and NASEEM (op.cit) also point out that in African agriculture, plant residues and animal wastes have been used to maintain soil fertility. However, most farmers practiced shifting cultivation more than the use of soil amendments to maintain fertility with as result low crop yields. When the soil fertility declined, farmers opened a new piece of land, allowing previously cultivated land to fallow for 10 to 15 years.

The same authors state that currently, the length of fallow rarely exceeds 2 to 3 years, a very short period to restore soil quality. Unfortunately, the decline in the length of fallow is not accompanied by the increase of fertilizers use, either organic or inorganic, to maintain soil quality and crop yields. The very low use of mineral fertilizers, which seems to be a general trend across the country, can be attributed to their unavailability, their high cost on the local market, the ignorance and poor knowledge of their use. This has a negative impact on agricultural production leading to low crop yields. However suggests that before using chemical fertilizers, probably because of their unavailability, high cost and the lack of knowledge of their use by farmers, to use all kinds of organic fertilizers such as cow dung, pig droppings, crop residues, chicken droppings and any other organic material.

DUSTIN (2013) notes that in a country like China, it has long been known that the supply of organic matter was essential in maintaining soil fertility and productivity. The organic matter is also a key factor in the nutrition of cultivated plants and also considered today as one of the most important indicators of soil quality. The supply of organic matter, which contains organic carbon, stimulates soil life as the organic carbon is an important resource for soil

microorganisms. But RANDRIANARISOA and BART MINTEN (2003) point out that the use of chemical fertilizers remains an alternative for increasing agricultural productivity. From an agronomic point of view, the use of compost and manure should not be taken as a perfect substitute of chemical fertilizers, but as a complement, if we want high crop productivity and the maintenance of fertility in major nutrients.

According to AFRICAFERTILIZER (2020), substantial use of chemical fertilizers is a prerequisite for successful efforts to improve agricultural productivity and hence the increase of agricultural production and income in Africa. No country in the world has achieved substantial agricultural growth without using them.

RANDRIANARISOA and BART MINTEN (2003) also emphasize the profitability of using fertilizers as an investment. A change in the price of fertilizers and / or in the prices of rice, will influence the interest in the use of fertilizers, and thus will cause a change in the rate of adoption of fertilizers. Likewise, the ability of available varieties to respond satisfactorily to fertilizer inputs will increase the motivation of producers to use more fertilizers, as the surplus obtained will be higher. Taking into account the results of the surveys and the above considerations, the combination of the use of organic and chemical fertilizers is suggested while ensuring their quality and quantity, their judicious application, accessibility and profitability. In addition to this suggestion, it is imperative to resort to varieties with high productive potential.

CONCLUSION

The present study on the evaluation of the use of fertilizers was carried out in the territories of Aru, Djugu and Irumu in Ituri; of Gemena in Sud- Ubangi; of Kabongo in Haut-Lomami and of Mbanza-Ngungu in Kongo-Central in DR Congo.

The objective of the study was to evaluate the level of the use of fertilizers in the context of Congolese agriculture, in order to appreciate the evolution of the modernization of this sector which is so crucial for the economy of the country. To collect the data on the use or not of the fertilizers by farmers, the descriptive and documentary methods as well as the techniques of direct observation, interview and questionnaire were used. Surveys by a reasoned choice were carried out by retaining in each selected province, one or a few territories, depending on human

and financial resources available, and where agriculture is the main activity of the population. In total, 561 cooperating and accessible farmers in the selected territories were subjected to the questions

The results showed that the majority of farmers surveyed (55.5%) do not use any type of fertilizers in their farming practices. However a relatively high proportion (38.8%) of the interviewed farmers uses the organic fertilizers consisted of different organic materials. The rate of their use is particularly high in Kabongo territory in Haut-Lomami, followed by Gemena territory in Sud-Ubangi province. The usual practices of peasants farmers (case of Kabongo territory) and the abundant source of plant materials due to the presence of equatorial forest (case of Gemena territory), may justify the importance given to the use of organic fertilizers in these regions.

For the chemical fertilizers; a very low percentage of farmers in the studied territories uses them, particularly those in the territories of Mbanza-Ngungu (25.0%) in the province of Kongo-Central and of Aru (9.2%) in the province of Ituri. The temperate climate prevailing in the territory of Mbanza-Ngungu allowing to grow temperate crops and the proximity of the territory of Aru to the Ugandan border through which many manufactured products from Asia and Europe pass may justify the use chemical fertilizers, although timid, in these regions. But in general, a low percentage (5.5%) of Congolese farmers does not use chemical fertilizers in their cultural practices. The use of fertilizers has therefore not yet reached a threshold that can sufficiently boost Congolese agriculture and promote the enormous potential of its agroecosystems. This forced the country to import basic foodstuffs.

Efforts must be made within the framework of agricultural policy in order to highlight the benefits of agricultural inputs and particularly those of fertilizers for Congolese agriculture which has an important development potential in the DR Congo. However, an evaluation of the quality and quantity of fertilizers according to the needs of the crops grown in the study area is recommended. Also, the use of seeds with high productive potential that can enhance the use of fertilizers leading to high crop yields and which can generate a satisfactory income for farmers can encourage their use in their agricultural practices.

REFERENCES

- CRUZ, J.F., HOUNHOUIGAN, D.J., HAVARD, M. et FERRE, T. (2019). La transformation des grains. Collection Agricultures tropicales en Poche, Quæ, Presses agronomiques de Gembloux, CTA, Versailles, Gembloux, Wageningen, 182 p.
- DUSTIN, L. (2013). Etude de l'impact des engrais verts sur les qualités physiques et biologiques des sols sableux en cultures maraîchères nantaises. Sciences agricoles. Dumas-00907284, 42 p.
- FAO, IFA et IMPHOS (2003). Les engrais et leurs applications. Précis à l'usage des agents de vulgarisation agricole. Quatrième édition, pp 1-6.
- KELLY, V.A and NASEEM, A. (2009). Fertilizer Use in Sub-Saharan Africa: Types and Amounts - Agricultural sciences Vol. II - Department of Agricultural Economics, Michigan State University, USA.
- KOTHARI, C.R. (1985). Research methodology. Wiley Western Limited, New Dehli, 500 p.
- LEBAILLY, P., MICHEL, R., et NTOTO, R. (2014). Quel développement agricole pour la République Démocratique du Congo ? Conjonctures congolaises.
- OGUET, H. 1989. La production et l'utilisation des facteurs de production en agriculture in TEKELIOGLU Y., *Agricultures méditerranéennes : la Turquie* (pp. 111-119). Montpellier : CIHEAM.
- OMASOMBO, T.J. (2021). Ituri. Terre et identités sous tension. Musée royal de l'Afrique centrale, Leuvensesteenweg 13. B-3080, Tervuren, pp 33 – 46.
- PEEMANS, J.-Ph. (2014). « Land grabbing and development history: The Congolese experience ». In Ansoms, A. & Hilhorst, Th. (éd.), *Losing your Land. Dispossession in the Great Lakes*. Martlesham: Boidell & Brewer, pp. 11-35.
- RANDRIANARISOA, J.C. et BART MINTEN (2003). Accessibilité et utilisation des engrais chimiques à Madagascar. Conférence "Agriculture et pauvreté", 20 mars 2003, Antananarivo. Centre National de la Recherche Appliquée au Développement Rural. Programme ILO.

TECSULT-AECOM. (2009). Etude du secteur agricole. Rapport préliminaire. Bilan - Diagnostic et Note d'orientation. République démocratique du Congo, Ministère de l'Agriculture et du Développement rural.

VALETTE, J.C. (2007). Méthodologie de l'enquête par questionnaire. Laboratoire Culture & Communication Université d'Avignon.

AFRICAFERTILIZER (2020). www.africafertilizer.org consulté le 15 juin 2020

CONGO-AUTREMENT (2019). www.congo-autrement.com consulté le 30 septembre 2019

SPORE.CTA.INT (2019). N°192/Mars - Mai 2019 : Digitaliser l'agriculture : réduire les inégalités hommes-femmes consulté le 15 juin 2020. www.spore.cta.int