International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 29 No. 3 Jun. 2020, pp. 508-511

http://www.ijias.issr-journals.org/

Effect of organic manure and mulch on growth and yield of Plantain (Musa AAB) in Ituri Province, in the North-eastern of DR-Congo

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ABSTRACT: The constraints threatening plantain production in the eastern of DR-Congo include soil fertility. An experiment was conducted at the National Institute for Agricultural Study and Research at Nioka Research Station to evaluate the effect of organic manures and mulch on growth and yield parameters of plantain (Musa AAB). This study revealed that response of organic manures was significant for all the parameters. Manure application enhanced significantly banana plant growth and yield. The highest bunches weight and yield were produced by the plants receiving manure (24.03t/ha) and mulch (23.24 t/ha) while, lowest bunches and yield were harvested in control plot without fertilizer (17.64 t/ha).

KEYWORDS: Banana, Mulch manure, Soil fertility, growth Parameters, yield.

1 INTRODUCTION

Bananas and plantains (*Musa* species L.) are important staple food crops and sources of rural income in most part of sub-Saharan Africa, particularly for the smallholders who grow them in compound gardens. Besides the production in heavily manured compound farms, *Musa* crops are produced in small fields under shifting cultivation and bush fallow, with yields declining rapidly after few production cycles [1]. The all year round fruiting habit of banana puts the crop in a superior position in bridging the 'hunger gap' between annual crop harvests [2]; therefore, contributing significantly to food and income security of people engaged in its production and trade, particularly, in developing countries [3].

Moreover, banana is considered an important food, because of its chemical composition and high content of vitamins and minerals, particularly potassium [3]; [4]; [5]. The pseudostems and leaves are commonly used as mulch in plantations, livestock feed and as wrapping material [5]. Dried leaf bases are extensively used as roofing material for houses, to weave ropes for tethering goats and sheep, and for mattress making [6]. In Eastern and Central Africa, banana is commonly grown by small-scale farmers [7]

Yield decline in plantain cultivation is a common occurrence after few production cycles due to low levels of soil organic matter and increased susceptibility to biotic stress [1]. The constraints threatening plantain production in the eastern of DR-Congo include soil fertility [8].

Better managements of soil fertility are imperative for rehabilitating degraded soil in order to increase crop yields in Africa, especially in South Kivu Province. For example, the strategies of application small doses of fertilizer and planting improved crop varieties were reported [9].

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2 MATERIAL AND METHODS

An experiment was established Jun 2016 at the Institut National pour l'Etude et la Recherche Agronomiques (INERA) Nioka Research Station, which is located at 02, 211.517 S, 30, 652.322 E and at an altitude of 1653, 6 mabove sea level (masl). Nioka Research Station is located in Ituri Province in the North-eastern of DR Congo. This trial was laid out in randomized block design on sandy soil with 3 replications. Plants were spaced at 3 x 2 m. The treatment plot size 6x9m and the replication measured 33x26m. The treatments included three treatments as follows : T1 : Cow manure (3kg/plant); T2 : Mulch (3 kg/plant containing 1.5 kg of *Titonia diversifolia and* 1, 5 kg of *Imperata cylindrica*) and To : control (no fertilizer). 5 kg of farmeryard were applied per planting hole for all treatment before planting for both T1 and 2. The manure and mulch were applied after planting and every 6 months (twice before harvest). Each tratment contained 9 banana plants.

Data were collected on the 9 growing plants treatment for recording. Planting, flowering and harvested dates were recorded. Banana growth parameters were assessed in the net plots at flowering stage, the measurements included plant height and pseudostem circumference at soil level. The number of functional banana leaves was also counted at flowering stage. Yield per plot was calculated by multiplying respective mean bunch weight with number of plants (9) in a plot and was expressed in kilograms. Yield per hectare was calculated by multiplying respective mean bunch weight with number of plants per hectare and it was expressed in tons per hectare.

All data were subjected to analysis of variance using the genstat software package [10]. The LSD test was used for means separation. In addition the relation between growth and yield parameters were assessed.

3 RESULTS AND DISCUSSION

3.1 BANANA GROWTH TRAITS

Organic fertilizers application enhanced plant height, pseudostem circumference at flowering and number of leaves per plant, although this effect was more pronounced for manure than for mulch application (Table 1). The organic fertilizers reduced number of days from planting to flowering in comparison with the control treatment. The result indicates that leaf area influences overall plant growth and confirms observations made by [11]. At banana flowering stage there was no significant effect of manure treatment on banana plant growth in comparison with mulch treatment. The height, circumference of flowering plants and the total number of leaves were lower in control treatment than in the treatment with organic fertilizers, but not significantly effect was observed between the different treatments for circumference and the number of leaves per plant. Contrary, Plants in amended plot with manure were significantly ($P<0.05$) early flowering (572.5 days) compared to the other treatments. These results corroborates the observation made by [11]; [12]; 13]; [14]; [15]; 16], he revealed that, fertilizer applications significantly affected banana pseudostem height, girth, leaf area and flowering dates.

Table 1. Effect of organic fertilizers on banana plant height, circumference, Number of days at flowering times and number of produced les per plants

Treatment	Height (cm)	Circumference (cm)	Number of days at flowering	Number of leaves
Manure	211.9a*	40.3a	572.5b	10.14a
Mulch	190ab	38.8a	638.4a	9.96a
Control	171.1b	34.3a	632.5a	9.82a
LSD	34.64	6.34	29.67	0.9
Fpr	0.069	0.154	0.001	0.785

**Means in a column followed by the same letter are not significantly different from each other according to LSD at P=0.05.*

3.2 BANANA YIELD PARAMETERS

From the data given in the Table 2, it is revealed that, the higher values for yield and yield parameters such as bunch weight, number of hands per bunch, bunches height and yield per hectare (23.64t/ha) were found in treatment which received organic fertilizer (T1 : manure and T2 : mulch), while, minimum was found in control treatment with no fertilizer (T0) which received (17.6 t/ha). The increase in bunch weight could be attributed to increase in yield attributing characters like plant girth, number of functional leaves and leaf area besides higher content of measure nutrients in indexing leaf [15]; [16]; [17], reported that application of NPK at a rate of 600 : 100 : 500 g /mat /yr respectively produced numerically the highest yield. In addition the

organic matter application accelerated bunches maturities (722.1 days) in comparison with mulch (801.6 days) no fertilizer application (777.4 days).

Table 2. Effect of organic fertilizers on banana yield, bunche weight, bunche length, number of hand and number of days bunches maturity.

Treatment	Yield (t/ha)	Bunche weight (kg)	Bunche length (cm)	Number of hand	Number of days bunches maturity
Manure	24.03a*	14.1a	56.91a	7.08a	722.1c
Mulch	23.24a	13.94a	58.81a	6.92a	801.6a
Control	17.64b	10.64b	50.1b	6.17b	777.4b
LSD	4	0.98	2.9	0.35	28.57
Fpr	0.005	0.001	0.001	0.001	0.001

**Means in a column followed by the same letter are not significantly different from each other according to LSD at P=0.05.*

4 CONCLUSION

The application of organic fertilizer is one of the important practices for improving banana yield in the poor soil.

From this study it could be concluded that organic fertilization with manure improves the growth and yield parameters.

ACKNOWLEDGMENT

Sincere gratitude and appreciation go to the team of persons who helped for data collection of the Institut National pour l'Etude et la Recherche Agronomiques (INERA-NIOKA).

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