***ISSN: 4906 -3448***
***Volume 10, Number 1, 2023***
***International Journal of Innovations in Biological Sciences***

# EFFECT OF CATTLE AND RABBIT DUNGS ON KENAF (HIBISCUS CANNABINUS L) IN BAUCHI, NORTHERN GUINEA SAVANNAH

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***ABSTRACT***

*The research work was designed to determine the growth and yield of kenaf (**Hibiscus cannabinus** L) in response to organic manure (cattle and rabbit manure) in Bauchi, Northern guinea savanna. The research was carried out at the instance un-availability and toxicity of chemical fertilizers, which have left farmers helpless. Organic manures have been proved to produce more healthy crops than chemical fertilizers. It has the required nutrients needed by plants in a fairly balanced proportion which can supply and sustain crops and have long residual effects, hence, maximum net returns. The materials were kenaf seeds, organic manure (cattle and rabbit manures) and polythene bags etc. The experiment was laid out in a randomized complete block design (RCBD) where treatments ($T_1$, $T_2$ and $T_3$) represent cattle and rabbit manures each at (7.5 t/ha) and control (0 t/ha) respectively. Five plant stands per plot were randomly selected and marked for data collection. This gives a total of 15 stands per treatment and 45 stands for three replicates. Data were collected on plant heights, stem diameters, number of leaves at 3, 5, 7, 9 and 11 weeks after planting (WAP) at two weeks interval while fibre length, width of fibre, dry weight of fibre, number of calyx per plot and weight of dry calyx were obtained after week 11. All data collected were subjected to analysis of variance. (ANOVA) and significant means were separated using Duncan's multiple range and least significant difference (LSD) at $P \leq 0.05$. The analyzed result showed that plant heights of(33.03cm, 51.00cm and101.17cm) and (28.75cm, 48.33cm and100.23cm)obtained from cattle and rabbit manures were higher than (19.83cm, 39.53cm and 84.60cm) obtained from control plots. Again, fibre length (98.33cm and 95.47cm) obtained from organic manures were longer than 74.17cm from control. This indicated that both the cattle and rabbit manures have significant effects on the growth and yield of kenaf in the study area. The study recommended that the Nigeria Fibre Company (NIFICO) AND Nigeria Fibre Product Limited (NFPL) be revived to boost Kenaf and other allied crops production among farmers.*

***Key words:*** *Organic Manure.*

## INTRODUCTION

The primary goal of any farmer is to improve the yield and quality of his farm produce per unit area. However, the choice and successful production of any new crop cultivated depended largely on the value attach to such crop, its available markets, processing mechanism as well as the climatic and the environmental requirements.

Kenaf (*Hibiscus cannabinus L),* is a fast growing and multi- purpose annual crop planted mainly for its economic and horticultural significance and a member of malvaleae family (Olanipekun *et al* 2016, Danalatus and Archontoulis, 2004). It is a native plant to east-central Africa where it has been grown for several thousand years for food and fibre. (Lemahieu *et al* 2003).

Many scientists reported that the plant originated from Africa where different kind of its species were identified and domesticated. It is related to many species in the hibiscus genus including roselle (*hibiscus sabburiffa*L.), okra (*Abelmochusesculentuus (L) moench*) cotton (*Gossypiumhirsutum)* and sisals., Lemahieu *at al* 2003). The plant according to FAO (2016) has been grown across various countries of the world including Nigeria, and South Africa. Kenaf (*hibiscus*) was introduced in china,

USSR, Thailand, south Africa, Egypt, Mexico and Cuba since world war II and its fibre use began in 1940s when jute imported from Assia was interrupted by the world war II. In the 1950s, the agricultural research service (ARS) of the US department of agriculture screened more than 500 plant species as potential fibre source for pulp, paper, robes, twine, bagging and other fibre products manufacturing as a result of which kenaf was selected as the most promising non-wood fibre plant (Lemahieu *at al* 2003). The traditional use of the crop according to liu, (2000) focused on its fibre production which was used for production of robes, sacks, canvas and carpets. The protein percentage of kenaf is as high as 15-30 % and can be included in animal feed as well as vegetables to man (Webber and Bledsoe, 2002). It is a common wild plant of the tropical and sub-tropical regions of the world with wide range of adaptation to climate and soils than any other fibre plants. It performs best in a well-drained and fertile sandy – loam soils requiring high insulation and precipitation (warm and moist climate with high temperature and rainfall (Liu, 2000; Adeniyan *et al*, 2014). If grown under required conditions, kenaf grows to a height of 8m within 8 months and yield as much as 30 tones/ ha (Lemahieu *et al*, 2003). It is a branched less plant growing to about 8ft to 14ft heights of 29ft under certain conditions.

Studies have shown that due to the collapse of the first national initiative on jute sacks production in Jos and Badagry by Nigeria Fibre Company (NIFICO) and Nigeria fibre products limited (NFPL) around 1971, it has become imperative to re-visit the products of jute/kenaf sacks in Nigeria again (Lemahieu *et al* 2003). Today, with the institute of agriculture research and training (IART) in conjuction with advanced technology availability, the country is riped for a sustainable development of kenaf bio- economy. However, this can be achieved only when investors are ready to invest in kenaf production and processing in Nigeria.

In-spite of the importance derived from kenaf, its cultivation is still restricted to a small area with low yield per unit area, hence; yield as low as 0.04% of the global production has been recorded in Africa (FAO, 2016). This may be associated to the fact that tropical soils are inadequate in minerals which therefore calls for addition of minerals element rich in soil nutrient to improve kenaf production. The poor fertility status may be due to, continuous land cultivation, increase population pressure on land requirement for infrastructures and farm land. Sufficient fertilization supply the required amount of plant nutrients needed for maximum net returns.

However, the detrimental effects of these mineral fertilizers on the environment in terms of toxicity and its high cost calls for the use of organic fertilizers which are more locally available and environmental friendly. Nigeria soils are low in their ability to retain soil moisture, catiron exchange capacity (CEC) and nutrients, hence, requires organic manure which have been proved to have environmental benefits and the capacity to improve soil structure (Adekunle *at al* 2014). Organic manures play significant roles in achieving sustainable agriculture, because it is a valuable source of both micro and macro nutrients required by plants (Taheri *et al*, 2011). Many investigators have pointed out to the fact that organic manures increase the growth, yield and improve soil fertility (Arsham, 2013). It is on the basis of these that this research work seeks to determine the effect of organic (rabbit and cattle) manure on the growth and yield of kenaf in Bauchi, Northern Guinea Savanna of Nigeria.

**Statement of Problem**

Increasing yield and quality of food production has always been and is still being one of the most important global issues. To achieve this set goal, according to Bekeko (2014), fertilizer is needed for its supportive effects to plant growth and yield. This must be made available to the plant at the correct proportion, usable forms and at the right time because adequate fertilization supply the required amount of plant nutrients needed to sustain maximum net returns. However, it has been noticed that the application of these chemical fertilizers to the soil has some adverse effects on the soils, hence, reduction in growth and yield of crops rather than high productivity. These include degradation of farmlands and soil erosion. Farmers use inorganic fertilizers to increase Kenaf yield in Nigeria, but many don't know that its detrimental effects, its high cost and its un-availability calls for the use of organic fertilizers that is locally available and environmental friendly (Olanipekun *et al*, 2021).

Inorganic fertilizers though can easily release ironic nutrients to the soil/ plant roots, have short residual effects in the soil, while organic fertilizers have long lasting residual effects. Apart from these, the increase cost of chemical fertilizer, its un-availability and toxicity effects have left farmers helpless resulting to decreasing quantity and quality of crops leading to a fall in the market price of their produce, consequently reducing farm income (Tung and Fermandes 2007). Not all farmers can afford the chemical fertilizers but organic manure is relatively cheap (cost-effective) and locally available. Organic manure is highly rich in organic matter and humus, thus capable of improving soil fertility and has the capacity to reduce acidity when added to the soils. As important as this (kenaf) plant and its economic value as well as health benefits are, it is only a few studies that focused on the effects of organic manure on the growth and yield performance. It is based on these that I have decided to carry out this research work to determine the effect of rabbit and cattle manures on the growth and yield of the plant (kenaf) (Hibiscus cannabinus L) in the study area.

**Aims and Objectives**

The main aim of this study is to observe the effects of organic (Cattle and Rabbit) manure on the growth and yield of Kenaf in Bauchi, northern Guinea Savanna. To achieve this set goal, the specific objective is:

To determine the effect of cattle and rabbit manures on the growth and yield of kenaf in the study area.

**Justification of the Study**

If suggestions and recommendations are of this work are adhered to, they will go a long way in improving the productivity and healthy crops with less toxicity for consumption. Constant application of organic manure will not only improve the levels of crop productivity, but also the fertility of our farm lands, since it has long lasting residual effects, cost-effective and relatively available, it will reduce the problems associated with chemical fertilizers. Kenaf production would be encouraged among local farmers in the study area and beyond.

**MATERIALS AND METHODS**

**Experimental Site**

The research was carried out in Bauchi state located in the northern guinea savannah of Nigeria. Bauchi lies between latitude $10^0$ 31' and longitude $9^0$ 84' and is about 2,044 ft. or 602m above sea level. It has mean annual rainfall of about 1095mm.The rainy season lasts for about 6-7 months in a year starting from April to October. The month with most rainfall is August with an average rainfall of 7.1 inches. Humidity ranges from 37% to 68%. Temperature in Bauchi is sufficiently warm year round that it is not entirely meaningful to discuss the growing seasons. Based on the location and climatic conditions, agricultural activity dominates the economy with millet, maize sorghum, rice, cassava, tomatoes and vegetables are as common crops cultivated in Bauchi. Cotton, peanuts and groundnut are the main cash crops of the state.

**Experimental Materials**

The under listed materials were needed for their specific functions, these include: kenaf seeds, organic manure (cattle and rabbit) polythene bags meter rule, weighing balance and thread.

**Experimental Design and Procedure**

The experiment was laid out in a randomized complete block design(RCBD) and replicated three times. The materials used include cattle, rabbit dung at 7.5t/ha each and a control at 0t/ha(T1, T2, T3) respectively. The materials (cattle and rabbit dungs) were incorporated and irrigated two weeks before planting. The seeds were planted in each of the polythene bag. A number of five stands per plot were planted with five seeds each and later thinned to two seedlings per stand out of which five plant stands were randomly selected and tagged in each bag for data collection. Parameters included Plant height, stem diameter, number of leaves, and were recorded at two weeks interval

(3, 5.7, 9 and 11 WAP). While fibre length, width and weight, number and weight of calyx were all recorded at the twelfth week.

**Data Collection and Analysis**

All the data collected (plant heights, stem girths, number of leaves, fibre length, width of fibre, weight of dry fibre, number of calyx and weight of dry calyx) were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan's multiple range and least significant difference (LSD) at P-< 0.05.

**RESULTS AND DISCUSSION**

The results of the data collected and analyzed are presented in the tables below. Tables 1, 2, and 3 showed an overview of the effects of cattle and rabbit manures on the growth, yield and number of leaves respectively while table 4 showed their effects on fibre length, width and weights, number of carlyx and weight of dry carlyx.

**Table 1: Effects of Cattle and Rabbit Dungs on Plant Heights at 3, 5, 7, 9 and 11 Weeks After Planting (WAP)**

| Treatment | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 |
|---|---|---|---|---|---|
| T1 | 33.03[a] | 51.00[a] | 75.67 | 90.18 | 101.17[a] |
| T2 | 28.87[a] | 48.33[ab] | 74.93 | 90.47 | 100.23[a] |
| T3 | 19.83[b] | 39.53[b] | 62.67 | 78.60 | 84.60[b] |
| SEM | 3.42 | 4.39 | 6.43 | 5.33 | 5.18 |
| LSD | * | * | NS | NS | * |

NS= Non significant
SEM= Standard error for mean
LSD= Least significant difference

The above table is an over view of plant heights from week 3 to week 11. The plant heights (T1) 33.03cm, 51.0cm, 75.67cm, 90.18cm and 101.17cm and (T2) 28.87cm, 48.33cm, 74.93cm, 90.47cm and 100.23cm were obtained from the plots treated with 7.5t/ha of cattle and rabbit manures respectively were taller than plant heights (T3) 19.83cm, 39.53cm, 62.67cm 78.60cm and 84.60cm obtained from plots treated without any manure (0t/ha). The result shows that there was significant difference in plant heights at week 3, 5 and 11 without any considerable statistical differences in plant heights at 7 and 9 WAP.

**Table2: Effects of Cattle and Rabbit Dungs on Stem Girths at 3, 5, 7, 9 and 11 Weeks After Planting (WAP)**

| Treatment | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 |
|---|---|---|---|---|---|
| T1 | 0.90 | 1.63 | 2.97 | 2.80 | 3.13[a] |
| T2 | 0.83 | 1.60 | 2.60 | 2.90 | 2.63[b] |
| T3 | 0.80 | 1.60 | 2.17 | 2.43 | 2.73[b] |
| SEM | 0.13 | 0.25 | 0.34 | 0.22 | 1.12 |
| LSD | NS | NS | NS | NS | * |

NS= Non-significant
SEM= Standard Error Mean
LSD= least significant difference.

The table indicates that statistically, there were no significant differences in stem diameters at 3,5,7 and 9WAP only at week 11. However, there was a gradual increase in stem diameters in T1, T2 and T3.

**Table 3: Effect of Cattle and Rabbit Dungs on Number of Leaves at 3,5,7,9 and 11 Weeks After Planting (WAP).**

| Treatment | Week 3 | Week 5 | Week 7 | Week 9 | Week 11 |
|---|---|---|---|---|---|
| T1 | 7.70 | 11.37[a] | 13.73 | 25.13[a] | 21.13[a] |
| T2 | 7.63 | 11.33[a] | 13.53 | 22.20[ab] | 18.80[ab] |
| T3 | 6.60 | 8.53[b] | 12.40 | 18.47[b] | 13.20[b] |
| SEM | 0.77 | 0.71 | 1.08 | 1.89 | 2.53 |
| LSD | NS | * | NS | * | * |

NS= Non-significant
SEM= standard error mean
LSD= least significant difference.

From the table, it can be seen that there was a significant difference in leaf number at 5,9 and 11 WAP, while there was any appreciable difference in leaf number at weeks 3 and 7. The leaf number of T1 (11.3,22.2and 18.8) and T2(11.3, 25.1 and 21.1) obtained from 7.5 t/ha of cattle and rabbit manures were significantly larger than leaf number of T3 (8.5, 18.5 and 13.2) obtained from control plots (0 t/ha).

**Table 4: Effects of Cattle and Rabbit Dungs on Fibre Length, Width of Fibre, Weight of Dry Fibre, Number of Calyx, and Weight of Dry Calyx.**

| Treatment | FL | WF | WDF | NC | WDC |
|---|---|---|---|---|---|
| T1 | 98.33[a] | 2.80[a] | 0.04 | 9.30 | 0.07[a] |
| T2 | 95.47[a] | 2.40[a] | 0.04 | 18.00 | 0.02[a] |
| T3 | 74.17[b] | 1.63[b] | 0.03 | 3.33 | 0.00[b] |
| SEM | 7.45 | 0.28 | 0.01 | 6.26 | 0.01 |
| LSD | * | * | NS | NS | * |

NS= non-significant
SEM= standard error mean
LSD= least significant difference

It can be observed from the table that there was significant difference in fibre length, width of fibre, and weight of dry calyx, while there was no any statistical difference in weight of dry fibre and number of calyx.

**Discussion of Results**

**Effects of Cattle and Rabbit Dungs on Plant Heights at 3, 5, 7, 9 and 11 WAP.**

From table 1 above, the plant heights of T1 (33.03cm, 51.00cm and 101.17cm) and T2 (28.87cm, 48.33cm and 100.23cm) were obtained from plots treated with cattle and rabbit dungs (7.5t/ha) and were significantly taller than those obtained in T3 (19.83cm, 39.53cm and 84.60cm) from control plots (0t/ha). The result indicated that there was significant difference in plant heights at 3,5 and 11 WAP. The findings tend to agree with many people else work, among whom are Olanipekun (2019) who reported that at 12 weeks after sowing kenaf, the plant height (194.0cm) obtained from organic fertilizer (160kgN/ha) was significantly taller than (184.4cm) from inorganic fertilizer (130kgN/ha). Locke *et al* (2000) observed that, farm yard manure (FYM) enhances kenaf growth. Also, in conformity to Hitha *et al* (2021) who revealed that crops grown on land treated with organic manure produced more healthy crops than those treated with chemical fertilizer. Again, Bekeko (2014) stated, adequate application of organic manure on land supplies the required amount

of nutrients needed by plant to sustain maximum net returns. Munnich, (2007) who found that fresh rabbit manure contains 2.4% N, 1.4% P and 0.06% K while other livestock such as cow dung contains 0.4% N, goat 0.6% N and poultry manure contains 1% N. This shows that cattle and rabbit manures have significant effect on the growth of kenaf plant in the study area.

**Effects of Cattle and Rabbit Manure on Stem Girth at 3, 5, 7, 9 AND 11 WAP.**

The results indicated that stem girths (0.90cm, 1.63cm 2.97cm 2.80cm and 3.13cm) were obtained from plots treated with cattle manure and stem girths (0.83cm, 1.60cm, 2.60cm and 2.63cm were from plots treated with rabbit manure while (0.80cm, 1.60cm, 2.17cm, 2.43cm and 2,73cm) were obtained from control plots. The result shows that statistically, there was no significant difference in stem girths at 3,5,7 and 9 WAP. It was only at week 11 that remarkable difference in stem girths was made. However, there was a gradual increased in stem girths from week 3 to week 11 in each treatment. The none difference may likely be due to climatic factors (rainfall that stop) and perhaps due to spacing since the seeds were planted inside polythene bags, and that might have had little space to expand width wise. Acreche *et al* 2005, affirmed to this fact by reporting, plant can only grow taller and thinner in highly populated fields thereby, lodged before maturity, but grow taller with larger girth in a well- spaced field. The significant difference agreed with Olanipekun, (2019) report, who stated that stem diameters (1.7cm and 1.8cm) obtained from plots that had organic fertilizer (100 and 130kg/ha) were significantly higher than stem diameters (1.5cm and 1.6cm) obtained from plots treated with inorganic fertilizer and that the least stem diameters (0.9cm and 1.4cm) were from plots without any fertilizers. The findings therefore, indicated that cattle and rabbit manures have effect on the stem girth of the kenaf planted.

**Effect of Cattle and Rabbit Manure on Leaf Number at 3, 5, 7, 9 AND 11 WAP.**

The result of the findings shows that the leaf number T1 (11.27, 25.13, and 21.13) and T2 (11.33, 22.20 and 11.80) obtained from plots treated with cattle manure and rabbit manure respectively were bigger than T3 (8.53, 18.47 and 13.20) obtained from control plots. That is to say, there was significant difference in leaf number at 5, 9 and 11WAP, while there was no reasonable statistical difference at 3 and 7 WAP.

The result also showed that there was gradual increase in leaf number at 3, 5, 7, 9 WAP but low at week 11 in all the treatments. This may be as a result of plants shading leaves as the weeks advanced. The result shows that both cattle and rabbit manures have influenced on the leaf number of kenaf. This is a conformity to Eleduma *et al* (2020) who revealed that the highest number of plant leaves (403.04) recorded in plant amended with (20t/ha) of organic fertilizer was significantly higher than (313.62) in control (0t/ha). It can be concluded that cattle and rabbit manures can affect yield of kenaf plant.

**Effects of Cattle and Rabbit Dungs on Fibre Length, Girth of Fibre, Weight of Dry Fibre, Number of Carlyx and Weight of Dry Carlyx**

The fibre length (98.33cm and 95.47cm) obtained from plots treated with cattle and rabbit manures were longer than (74.17cm) obtained from control plots. Similarly, fibre girth (2.80cm and 2.40cm) from using cattle and rabbit manure were significantly bigger than 1.63cm obtained from control. Again, the weight of calyx 0.01 grams and 0.02grams from cattle and rabbit manures were also bigger than 0.00 grams from the control plots. These results indicated that there was significant difference in fibre length, fibre width and weight of dry calyx when 7.5 t/ha of cattle and rabbit manures were applied, hence significant effect on the yield of the said plant (kenaf). However, there was no any considerable difference in weight of dry fibre and number of calyx when the same 7.5 t/ha of cattle and rabbit manure were used. This agreed with Olanipekun *et al* (2016) who stated, the application of organic manure at varying rates increased the best fibre yield of kenaf from 67.29gm2 (control) to 98.70gm2 (organic manure). It also agreed with Lemahieu *et al* (2003) who reported within eight months of planting, kenaf plant can give as much as 30 t/ha yield. From the findings, cattle and rabbit manures have significant effects on both growth and yield of kenaf in the study area.

## CONCLUSION AND RECOMMENDATIONS.

From the research, it can be concluded that the application of organic manure at 7.5 t/ha gave significant difference in growth parameter (plant heights and stem girths) and yield parameters (leaf number, fibre length and calyx). Farmers in the study are can use 7.5kg/ha of both cattle and rabbit manures to cultivate kenaf. All things being equal, using organic fertilizer for kenaf production is profitable. Based on the findings of this study, the following recommendations are hereby advanced: Further research work can be conducted with much higher levels of organic manure to attain profitable kenaf production. More investigations should be made on the plant to evaluate the fibre and seeds yield under varying rates of organic fertilizers or to determine the response of kenaf plant to varying population density(spacing) as it affects fibre and seeds yield. Government should re-visit/revive the Nigeria fibre company (NIFICO)and Nigeria Fibre Product Limited (NFPL) initiated around 1971 to boost kenaf and other allied crops among Nigerian farmers.

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