COMPARATIVE ANALYSIS ON DIFFERENT LEVELS OF ORGANIC AND INORGANIC FERTILIZERS ON THE PERFORMANCE OF ROSELLE(*Hibiscus Sabdarifa L.*)

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BY

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A PROJECT SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL EDUCATION, SCHOOL OF VOCATIONAL EDUCATION, FEDERAL COLLEGE OF EDUCATION (TECHNICAL) GOMBE, IN AFFILIATION WITH ABUBAKAR TAFAWA BALEWA UNIVERSITY BAUCHI IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR DEGREE OF TECHNOLOGY (B.TECH.ED) IN AGRICULTURAL EDUCATION.

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APPROVAL PAGE

This project work has been approved as meeting the requirement for the award of B.Tech.Agric Education. Abubakar Tafawa Balewa University Bauchi Nigeria.

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DEDICATION

This project work is dedicated to Almighty God who preserved my life to date and gave me the opportunity to pursue B.Tech.Agric (Edu) and to my parents; Mr. and Mrs. A. A. Dodo for their prayer and support in every area of my life.

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Finally, I appreciate my family members especially my wife and my kids; Deborah and Ibrahim whose prayers have protected me throughout my stayed in the school and also my colleagues who helped me in one way or the other throughout this period.

ABSTRACT

This research work was carried out at the experimental farm of the Department of Agricultural Education, School of Vocational Education, Federal College of Education (Technical) Gombe with the aim of making comparative analysis on different levels of organic and inorganic fertilizers on the performance of roselle (Hibiscus sabdariffa L.). The research design used is Randomized Complete Block Design (RCBD). Two different levels of fertilizers was applied. Data were collected on 45 randomly sampled and tagged plant at the middle of the net plots that is plant height, number of leaves and number of branches per plant. The data was analysed using statistical means and analysis of Variance (ANOVA). The result indicated that NPK 2.25kg/ha gives the highest yield as shown at 6 WAS which recorded the tallest plant height with 54.10cm and shortest at 2 WAS which indicated 7.40cm while the poultry droppings recorded 17.20cm at 4 WAS. At 2 and 4 WAS poultry dropping recorded the highest number of leaves while at 6 WAS NPK recorded the highest number of leaves with 150.20 leaved at 4 WAS. Poultry dropping recorded the highest number of branches with 5.00 while at 6 WAS NPK recorded the highest number of branches with 8.10. Therefore as highlighted by the findings of this study. The result indicated there is no significant difference between the two (2) levels of fertilizer application on roselle plant. Based on the findings of this study, the following recommendations are drawn, the farmers should use either NPK or poultry dropping when cultivating roselle because both of them gives optimum yields, farmers should engage in rearing poultry even in a small scale in order to obtain poultry dropping.

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CHAPTER ONE

INTRODUCTION

Roselle (*Hisbiscus sabdariffa* L.) belong to the family malvacea. locally called "karkade", is an important annual crop grown successfully in tropical and sub-tropical climates. The commercially important part of plants is the fleshy calyx (sepals) surrounding the fruit (capsules). The whole plant can be used as beverage or the dried calyces can be soaked in water to prepare a colorful cold drink or may be boiled in water and taken as hot drink. It also has some medicinal properties.

The seeds contain 17.8 – 21% non-edible oil and 20% protein and are sometimes used for animal feeds. Roselle is a flexible plant with a number of uses. It is intercropped with crop stables such as sorghum and sesame or planted along field margins. It requires little care. Its leaves seeds capsules and stems are used in traditional medicines. In rural areas women are usually responsible for growing Roselle. They ad value to the crop by developing products for markets. Wilson and Menzel (2006) reported that *Hibiscuss sabdariffa* var. *Atinssima* grown for its phloem fiber. Despite its potential economic importance, karkadi has received little attention and there is a lack of information regarding its genetics. breeding and production. particularly under rain fed conditions.

1.1 Origin and Distribution

Roselle may have been domesticated in Western Sudan before 4000 BC, it was first recorded in Europe in AD 1576. It seems to have been carried from Africa to the new World by slaved for use as a food plant. Roselle is native from India to Malaysia, where it is commonly cultivated and most have been carried at an early date to Africa. it has been widely distributed in

the tropics and subtropics of both hemispheres, and in many areas of the west indies and central America has become naturalized. The Flemish botanist, Ahmed (2000), published his observations of the plant and the edibility of the leaves which was recorded in Jara, 1999. Seeds are said to have been brought to the new world by Africa slaves. Taken to the new world, Roselle was cultivated in mexico, parts of central America, the west indies, and in southern Florida, Texas and California in the late 19th century.

The use of *Hibiscus sabdariffa* for fiber seems to have developed in regions other than Africa, most breeding of Roselle has been for its fiber yield. Sudan is presently the major producer of Roselle, however, farmers regard it as a famine food. When drought is expected, farmers prefer to cultivate Roselle rather than cereals because of its hardiness under adverse conditions. Roselle if grown for its calyces, which are exported from Sudan, China and Thailand, and it is also grown for its calyxes in Mexico. Karkade is grown in various parts of Sudan, particularly kordofan and Darfur. It is one of the cash crops cultivated by traditional farmers in kardofan and Darfur states under rain fed conditions, where large quantities are produced both for local consumption and for export.

Roselle names is known in different countries by various common names, including roselle, razella, sorrel, red sorrel, Jamaican sorrel, Indian sorrel, guinea sorrel, Indian sorel Guinea sorrel, sour-sour, and Queensland jelly plant. In English speaking countries it is known as roselle, rosella hemp, natal sorrel and rosella. The Japanese name is rohzelu, also sabdariffa or lalambari in Urdu and lal-ambari , pativa or kalambaar in Hindi. In French, roselle also is the world for the red-winged through. In Switzerland, the edible calyx is called karkade. The roselle fiber is called India rosella hemp, rosella fiber, rosella hempor pusa hemp. Vernacular names for roselle include rosella, jelly okra, lemon bush and florida cranberry.

Hawaiian Agricultural experiment station received seeds from "Puerto Rico" at that time there was much interest in inter-planting roselle with ceara rubber (*Manihot Glazioril Muell*) Roselle become and remained a common home garden crop throughout southern and central florida until after World War II when this area began to develop rapidly and home gardening and preserving declined. Mrs. Edith Trebel of Estero, florida was one of the last remaining suppliers of roselle jelly. In February, 1990, Mrs. Edith purchased the last two jars made from the small crop salvaged following the 1990 hurricane and before frost killed all her plants.

Mclean (2001) referred to the cultivation of roselle as a "recent" crop in Egypt, where interest is centered more on its pharmaceutical than its food potential. It was reported that roselle clyces produced and dried in Senegal particularly around Bambay, were being shipped to Europe (Germany, Swizterland, France and Italy) at the rate of 25 tons annually. Wester (1990) describe varieties in three (3) named, edible cultivars as being grown at that time in the Philippines. "Rico" (named in 1912) plant relatively low growing spreading with simple leaves borne over a long period as the lobed leaves mostly 3-parted. Flower has dark- - red eye and golden – yellow pollen mature .calyx to 2 in (5cm) long and to ¼ in (3.2cm wide. brack phimp and stiffy horizontal. highest yielder of calyces per plant juice and preserves of calyx and herbage rich red.

"Victor"- a superior selection from seedling grown at the subtropical garden in Miami in 1991.plant taller to 7ft (2.13m) more erect and robust flower has dark-red eye and golden-brown pollen it blooms somewhat earlier than 'Rico' calyces as long as those "Rico" but slenderer and more pointed at apex, bract longer, slenderer and curve upward. Juice and preserve of calyx and herbage rich-red.

"Archer" (sometimes called white sorrel) resulted from seed sent to Wester by A. S. Archer of the Island of Antiqua. It is believed to be the albus. Edward long referred to "white" as well as red roselle as being grown in most gardens of Jamaica in 1990s. plant is as tall and robust as "victor" but has green stems. Flower is yellow with deeper yellow eye and pale-brown pollen. Calyx I green or greenish-white and smaller that in the 2 preceding, but the yield per plant is much greater. Juice and other products are nearly colorless to anbir. Green fruited roselle is grown throughout Senegal but especially in the cape verd region, mainly for use a vegetable. Another roselle selection which originated in 1982 at the Lamao experiment station and was named "temprano" because of its early flowering, Wester reported as no longer grown, the plant being less robust and less productive than the others. A strain with dark-red, plump but stubby calyces (the sepal scarcely longer than the seed capsule) is grown in the Bahamas.

It is grown extensively in the semi-arid savanna for local consumption and the export to the middle east and Europe. The red acid succulent calyx are boiled with sugar to produce sorrel drink, they are also made into jellies, sauces, chutency and preserved (Gibbon and Adam, 1993). The seeds contains about 17 to 20% oil. The seeds are boiled fermented and dried for use as condiment for local soup preparations (Yakuwa or Batso in Hausa) before the arrival of modern substitutes (e.g Maggi). Gibbon and Adam (1993), the fruit contain 10% fats and oil and 12% carbohydrate. Its calyx contains 4% citric acid (Purseglove, 1991). Besides food, the traditional preparation from various parts of the plant such as flowers, leaves, calyx and corolla of the roselle are used as remedy for various illness.

Medicinal and industrial applications of the roselle plant have been developed around the world. In china it many medicinal used to treat hypertension, pyrexia and hive damage and in ayurvedic medicine. Recently, the sepal extract has been used as an effective treatment against

leukemia due to its high content in polyphenols, particularly protoratechnic acid. The overall characteristics of roselle seed oil allow for important industrial application and represent added value for its cultivation. Roselle also has certain therapeutic properties, the reported benefits off taking it internally in the form of herbal tea include soothing colds, clearing and blocked nose and promoting kidney function, aiding digestion as a general tonic, as a diuretic and helping to reduce fever. Taken as a drink made from the calyx, it is a mild diuretic and purgatic, among many other effects. The drinks is said to be a folk remedy for cancer. Restored roselle drink has no bacterial isolate.

1.2 Botanical Description

Roselle is an annual erect shrub that takes five months from planting to harvesting; it can also be regarded as a perennial species grown for their fibre are tall, with fewer branches, sometimes growing to more than 3 – 5 m in height. The production of the roselle in the savannah is on the increase. It plays an important role in the lives of people ranging from rural dwellers to urban settlers. The uses of roselle include making use of calyxes of green type to make soup. And the calyx of red type is boiled with hot water, the purple/red coloured extract is strained, sweetened as flavoured as a drink called "zobo" the tender leaves and shoots are eaten is salads and soups and the drinks made from roselle through calyx are the most expensive sources of vitamin 'C' (Babajide et al, 2004) in Okosun, Magaji and Yakubu, 2006). Consequently, the calyxes have received industrial attention internationally, (Egharevba and law-Ogboma,2007). Therefore, there is need for the production of roselle to be increased to meet the demand of the people.

Climate

Roselle requires a monthly rainfall ranging from 130 – 250 mm in the first three to four months of growth. Dry weather is well tolerated, and is desirable in the latter months of growth. Rain or high humidity at harvest and drying times can downgrade the quality of the calyces and reduce the yield.

1.3 Statement of the Problem

It is always a easy matter from scientific and technically view points to like all the plants of which roselle is not an exception. Roselle (*Hibiscus sabdariffa* L.) is required for it's tremendous contribution to food security most especially for it's nutritional composition such as Vitamin 'C'. The crop is not made available all the times when needed. The few that are supplied to market always fails to meet the need of the people.

1.4 Purpose of the Study

This research work is aimed at comparing the different levels of organic and inorganic fertilizer on the performance of roselle (*Hibiscus Sabdariffa* L.). The specific objective is to:

i. To investigate the comparative analysis on different levels of organic and inorganic fertilizers on the yield of Roselle

ii. To study the best performance between the two levels of fertilizers

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The research work involves the study of different level of organic and inorganic fertilizers on the performance of roselle with the views of various authors on the cultivation of reselle (*Hibiscus Sabdariffa* L.) been considered.

Tindal (2003), mentioned the common names of (*Hibiscus sabdariffa* L.) as roselle, red sorrel, Jamaican sorrel, India sorrel (England) oseillede guines (france), seveni (span Zuur, Roselle, Sour-sour (West Africa), Isapa, Aukan (Nigeria). Williams et al (2000), stated that the common names of roselle is based on the environment.

2.2 Botanical Description

Tindal (2003) narrated that roselle is herbaceous variable in habit, up to 8 feets higher. The stems are red or green woody, leaves vary in shape and size upper ones may have only two lobes. Flowers are yellow, sometimes with dark red centre. Base of flowers (sepal collectively called calyx swells and become fleshy, forming edible part of the flower. Fruit up to inch long, oval, with several seeds when ripe. Seeds numerous, curved, covered with scaly tissue, containing 17 percent oil.

Adam (2003), stated that the plant is an erect branched annual shrub which reaches a height of 1 – 3cm, the stem bear alternate glabrous leaves in long petioles, usually divided into three or five lobes with erected margins. The flowers are borne on very short penduncles in the axils of the upper leaves. In variety sabdariffa, the epicalyx is made up of 10 linear fleshy

bracteoles and the calyx is 8 lobes, becoming large and fleshy after flowering. In variety altissima the fibres are produced in layers just under the bark of the stem. The stand of short length of sclerenchy cell.

Tindall, 2003 stated that most species and cultivars of roselle have a light rate of nitrogen absorption and surface dressing of nitrogenous fertilizer are normally required during the period of active growth. In some areas, additional application of potassium may also be necessary.

2.3 Environmental Response

Adam (2001) stated that the crops (roselle) grown best on good soil but will tolerate very heavy soils or water logging and needs well distributed rain fall of 200 – 600mm during the season. The crops can withstand warmer, more humid weather than kenaf but is more susceptible to low temperature damage.

Tindall (2003) discussed that the environmental requirement of roselle is being tolerant to aide range of environmental conditions, particularly well suited to cultivation in hot regions on a wide range of soil. Some cultivars will also give economic yield in wet humid areas although optimum rainfall is 8 – 20 inches distributed over 3 – 4 months. Sensitive to day length, required a short day 12 to 12.5 hours.

Mclean, (2001) stated that roselle grows in loamy well drained soil mainly in tropical climate and requires rainfall averaging about 10 inches (25cm) in month throughout the growing season. Paul (2003) shows that roselle adopts to a wider range of soil but economic yield are only obtained on soils which are well supplied with organic matter and essential nutrient plants have deeply, penetrating roots systems. Tolerance relatively high temperature throughout the growing and fruiting period. Some cultivars give satisfactory yields in wet humid area although

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the optimum rainfalls is approximately 45 – 50mm distributed over 90 – 120 days growing period. Roselle is a short day plant, requiring 11 – 12.5 hours of day length following and fruit production.

William and Babatunde (2001) response of red varicty roselle (*Hibiscus sabdariffa* L.) to some agronomic practices. If this crops (roselle) is sown in well prepared moist seed-beds and the other climate conditions are favourable, germination is completed within 3 – 6 days and early growth is very rapid. This means that the crop soon form a good canopy and give well little change to growth. The selective herbicides Alachbor and Metalachor at 1.0kg/ha have been found effective in controlling weeds in roselle for up to 8 weeks after planting.

Harvesting should be done soon after flowering starts. the best time to harvest being when a few (8 – 10) flowering are in the bloom. At this stage, the fibre is at its best quality and easily separable. Delayed harvesting makes the fibres coarse and of poor luster. The stems are cut at ground level with a hand sickle or machete and tied into bundles. The leafy tops are water source for processing.

2.4 Economic Importance/Utilization

Tindal (2003), young shoot and level of roselle are cooked. also swollen bases of flowers (calyx). The roselle produce a good fibre, which is used for making ropes. fishing nets, bags and sacks. The seed contain 17 – 20% oil, therefore, it is a good sources of industrial oil. the oil can be used as a lubricant and lamp fuel. The leaves are used in preparing palatable soup and young leaves consumed as salad. Roselle fruits are used in making sobo drinks.

Pests and Diseases

The common pests that attack roselle depend on the states of development but usually it is nematods, stem borers, black flea bettles, cutting aphid etc. The disease that attack (*Hibiscus sabdariffa L.*) include dry root, leaf blight, leaf spot, stem-rot etc.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Description of Experimental Site

The experiment was carried out in 2017 cropping season at the experimental farm of the Department of Agricultural Education, school of Vocational Education, Federal College of Education (Technical), Gombe is located in Northern Guinea Savannah of Nigeria between latitude 9°11'N and longitude 11° 14'E (Kwari and Rayer, 1998). The climate in the region consists of 2 distinct seasons, raining season (May to October) and dry season (November to April). The mean of annual rainfall is about 850-1000mm (Kowal and Knabe, 1997) with the peak in August adequate rainfall amount are received in Gombe area during rain fed cropping period of June to September, mean daily temperature ranging from 20° to 30°C.

3.2 Experimental Materials

The experimental materials used for this research work is one variety of roselle (*Hibiscus sabdariffa L.*). The planting material was obtained in Gombe main market at Abubakar A. A. Minangi Agro Nigeria Limited.

3.3 Treatments and Experimental Design

The treatment consist of one roselle variety (Rico) and two levels of fertrilizers which are organic and inorganic, laid out in a Randomized Complete Block Design (R.C.B.D) with three replications. The plot size was 54.5cm and 1m pathway between the replications and subplots respectively. The total experimental area is 17m x 5m ($85m^2$).

3.4 Method of Data Collection

The data were collected on plant height, number of leaves and number of branches. The data was collected on 15 sampled stands from each replicates making the total of 45 stands to represent the entire population. 15 plants were sampled and tagged for easy identification. The parameters were collected at two (2) weeks with the use of a ruler, thread and rope.

3.5 Cultural Practices

The field was prepared by clearing the stumps and debris using hoe followed by marking out using measuring tape and peg. The seed was sown on 10th - August 2017 by drilling method with the spacing of 50 x 40cm. The seed germinate on 14th - August 2017 were thinned to 2 per stand after 2 weeks of sowing (WAS) (IAR. 2013).

3.6 Treatment and Experimental Design

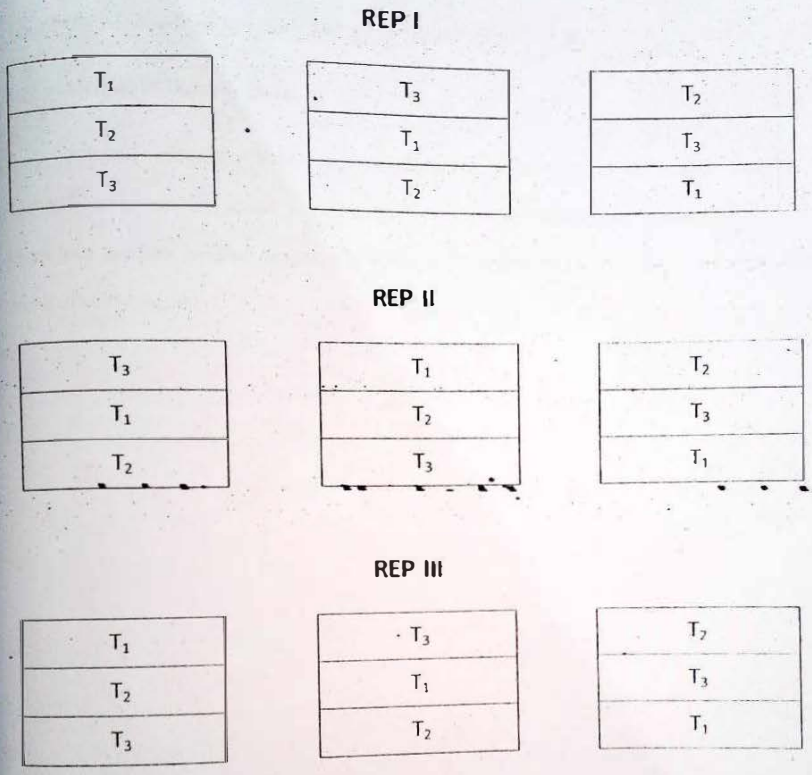

Fig. 1: Experimental Design and Field Layout in a randomized Complete Block Design

T_1 = NPK fertilizer

T_2 = Poultry dropping

T_3 = Control

SE = Standard Error

P≤ F = Significant Effect

LSD = Least significant difference

3.6 Weed Control

The weeding was carried out using hoe at regular interval of 2 weeks.

3.7 Method of Data Analysis

All data collected will be analyzed statistically using Analysis of Variance (ANOVA). The differences between mean will be tested for the significant effect of all the treatment. The result will indicate whether organic and inorganic fertilizer will have great significant at 5% levels of significance.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Growth Parameters

4.1.1 Comparative analysis on different levels of Organic and Inorganic Fertilizers on Plant Height in Federal College of Education (Tech.) Gombe in 2017 cropping season.

The comparative analysis on different levels of organic and inorganic fertilizers on plant height in Federal College of Education (Technical) Gombe is presented in table 1. There was no significant ($P \leq 0.05$) effect on different levels of organic and inorganic fertilizer on the performance of roselle at 2, 4 and 6 WAS.

At 2 WAS NPK recorded the tallest plant height with 7.40cm and the shortest plant height was control with 5.70cm, while at 4 WAS poultry dropping indicated the tallest plant height with 17.20cm the shortest was the control with 13.90cm and at 6 WAS NPK recorded the tallest with 54.10cm and the shortest goes to control with 38.90cm respectively.

Table 1: comparative analysis of different levels of organic and inorganic fertilizers on plant height in Federal College of Education (Tech.) Gombe in 2017 cropping season.

Treatment	2WAS	4WAS	6WAS
NPK	7.40	16.90	54.10
Poultry dropping	7.10	17.20	48.60
Control	5.70	13.90	38.90
SE	0.91.	1.82	7.69
P<F	NS	NS	NS
LSD	5.44	10.95	46.18

4.1.2 Comparative Analysis of different levels of Organic and Inorganic Fertilizers on Number of Leaves in Federal College of Education (Tech). Gombe in 2017 cropping season

The comparative analysis of different levels of organic and inorganic fertilizers on number of leaves in Federal College of Education (Tech.) Gombe is presented in table 2.there was no significant effect at all the weeks. At 2 WAS. 4WAS poultry dropping recorded the highest number of leaves with 7.40 and 28.20 leaves. At 6WAS NPK recorded the highest number of leaves with 150.20 leaves and control was the least with 79.20 leaves.

Table 2: The comparative analysis of different levels of organic and inorganic fertilizesr on number of leaves in Federal College of Education (Tech.) Gombe in 2017 cropping season.

Treatment	2WAS	4WAS	6WAS
NPK	6.50	20.70	150.20
Poultry dropping	7.40	28.20	143.40
Control	6.20	26.20	79.20
SE	0.62	3.88	39.18
P<F	NS	NS	NS
LSD	3.74	23.31	235.09

4.1.3 Comparative analysis of different levels of organic and inorganic fertilizer on number of branches in Federal College of Education (Tech). Gombe in 2017 cropping season

The comparative analysis on different levels of organic and inorganic fertilizers on number of branches in Federal College of Education (Tech.) Gombe is presented in table 3. There was no significant ($P \leq 0.05$) effect at 4WAS poultry dropping recorded the highest number of branches with 5.00 and the least was NPK with 3.40 at 6WAS NPK recorded the highest number of branches with 8.10.

Table 3: The comparative analysis of different levels of organic and inorganic fertilizers on number of branches in Federal College of Education (Tech.) Gombe in 2017 cropping season.

Treatment	2WAS	4WAS	6WAS
NPK	0.00	3.40	8.10
Poultry dropping	0.00	5.00	7.10
Control	0.00	3.70	7.10
SE	0.00	0.85	0.92
P<F	NS	NS	NS
LSD	0.00	5.10	6.12

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

This research work was carried out at the experimental farm of the department of Agriculture Education. School of Vocational Education. Federal College of Education (Tech.) Gombe during 2017 cropping season on comparative Analysis of different levels of organic (poultry droppings) and inorganic (NPK) fertilizer on the performance of Roselle (*Hibiscus sabdariffa L.*). The parameters included plant height. number of leaves and number of branches at2 weeks interval that was 2. 4. and 6 Weeks After Sowing (WAS).

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The data collected was analysed using Analysis of Variance (ANOVA) and the mean obtained were compared using Least Significance Difference (LSD). The result indicated that. there is no significance difference ($P>0.05$) at all the level of organic and inorganic fertilizers on the growth performance of roselle (*Hibiscus sabdariffa* L.).

5.2 Conclusion

According to the findings of this study. NPK as inorganic fertilizer is the best fertilizer to be used. since it recorded the highest number of leaves. tallest plant and highest number of branches compared with control and with poultry dropping as organic fertilizer. Though there is no significance difference between the performance of poultry dropping and NPK fertilizer but still NPK shows superiority in terms of growth parameters.

5.3 Recommendation

Based on the findings of this study the following recommendations were made:

i. Farmers that are involved in cultivation of roselle should use NPK fertilizer for optimum productivity.

ii. Government should provide fertilizer at appropriate time for farmers to make use of it during rainy season.

iii. Government should ensure regular water supply so that farmers can engaged in dry season farming most especially vegetable of which roselle is not an exception.

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