**A**

**RESEARCH PROJECT**

**ON THE TOPIC:**

**EFFECT OF DIFFERENT ORGANIC AND INORGANIC FERTILIZERS ON THE GROWTH AND YIELD OF CUCUMBER (*Cucumis sativus L.*)**

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**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background of the Study**

Cucumber *(Cucumis sativus L.)* is a widely cultivated vegetable crop belonging to the Cucurbitaceae family, which includes other important vegetable crops such as pumpkin, watermelon, and squash (Kumar *et al.,* 2019). The nutritional composition of cucumber fruits is found to be rich in essential nutrients, including vitamins, minerals, and dietary fiber (Li *et al.*, 2021). Cucumber is primarily grown for its edible fruit, which is consumed raw or processed into pickles, salads, and other food products. Cucumber has been cultivated for thousands of years and is believed to have originated in South Asia (Kato, 2000). Today, cucumbers are grown in many countries around the world, with the largest producers being China, Turkey, Iran, Russia, and the United States. According to the Food and Agriculture Organization of the United Nations (2021), global cucumber production in 2020 was approximately 86.2 million tons, with China alone producing 76% of the total. Cucumber *(Cucumis sativus L.)* growth and yield is affected by different factors such as; climatic, pests, diseases, weed infestation and low soil fertility (Kumar *et al.,* 2019). For increased productivity of any crop, soil fertility plays a major role and Cucumber is not exceptional. To boost cucumber production, there is need to pay attention to the poor soil fertility in West Africa by augmentation of the soils with either organic or inorganic fertilizers (Bai *et al.,* 2019). Organic fertilizers or manure include; compost manure, plant residues, animal dung, among organically sourced waste which is useful for plant growth (Afzal *et al.,* 2018). Organic fertilizers or manure has been reported to be improve soil organic matter, soil structure and texture in general and could be useful to boost soil fertility (Afzal *et al.,* 2018). Inorganic fertilizers could either be simple or compound fertilizers (FAO, 2018). simple inorganic fertilizers contain a single or specific nutrient or element (e.g., nitrates fertilizers which gives nitrogen for plant growth) (FAO, 2018.). The compound fertilizers are combined elements (E.g., NPK fertilizers) which gives plant nutrients at different ratios (Chen *et al.,* 2018; FAO, 2018). Inorganic fertilizers are equally important to boost soil fertility. Hence, to increase cucumber productivity index in West Africa (Nigeria), there is need to evaluate the growth and yield effect of organic and inorganic fertilizers.

**1.2 Economic importance of Cucumber**

Cucumber is an important crop with significant economic importance worldwide. It is widely cultivated and consumed due to its high nutritional value and versatility in culinary applications (FAOSTAT, 2021). Cucumber is a good source of vitamins and minerals, including vitamin C, vitamin K, potassium, and magnesium. It is also low in calories and high in water content, making it a popular vegetable for weight loss diets. The nutritional value of cucumber contributes to the health and well-being of consumers, leading to reduced healthcare costs and increased productivity   
(He *et al.,* 2022). Cucumber is used in a variety of culinary applications, including salads, sandwiches, pickles, and smoothies. The versatility of cucumber in cooking and food processing has led to the development of a diverse range of value-added products, such as cucumber juice, cucumber powder, and cucumber chips (He *et al.,* 2022). The production of cucumbers provides employment opportunities for farmers and contributes to the economic growth of producing countries (FAOSTAT, 2021). The export of cucumbers generates foreign exchange earnings and contributes to the balance of trade of high producing countries such as; Spain, Mexico, the Netherlands, Morocco, and Turkey (ITC, 2021). Hence, Cucumber is beneficial to the producers, consumers and the government.

**1.3 Justification of the Study**

There is a common knowledge that soils of the tropics are generally low in nutrient and high in acidity. This is attributed to continued cultivation of the land, high rainfall and the attendant erosion problem of the soils. The fertility of the soil was greatly increased by the help of different organic manure, and this will inversely improve the soil nutrient status and structure, reduce the acid content of the soil, hence an increment in crop yields and productivity. This study will generally create an awareness to the general public on the effectiveness or usefulness of organic and inorganic manure in agriculture. This study will also immense benefits researchers on the economic value of organic and inorganic fertilizers and how it relates to cucumber production with abundant economic importance to the people.

**1.4 Objectives of the Study**

The objectives of the study are;

1. To determine the effect of different organic fertilizers (manure) on the growth and yield of cucumber *(Cucumis sativus L)*.
2. To determine the effect of different inorganic fertilizers on the growth and yield of cucumber *(Cucumis sativus L)*.

**CHAPTER TWO**

**LITERATURE REVIEW**

* 1. **An Overview of Cucumber Production in Nigeria**

The demand for vitamins and minerals are highly dependent on vegetables. Cucumber and other fruit and leafy vegetables are in high demand because of their nutritional and economic values. According to Adeoye and Balogun, (2016), cucumber production has the capacity to enhance agricultural production, economic empowerment and food security. They are consumed fresh, as desserts in after meals, juice or in combination with other food materials. Cucumber production in Nigeria is majorly for local consumption, although Nigerian cucumbers are sometimes exported to neighbouring countries of West Africa like Chad, Cameroun, Niger and Benin Republics. Due to its importance, it ranks among major horticultural crops cultivated in Nigeria. Others are citrus, mango, African star apple, watermelon, banana, avocado pear and pineapple rank among major crops in Nigeria. Like most vegetables, its production is profitable due to high amount of cash income per unit area compared to some other crops. Cucumber is cultivated in every part of Nigerian agro ecology. This cuts across the rainforest to the savannah zones of Nigeria with the production pattern and volume varying from place to place. The 5 highest cucumber producing states in Nigeria are Plateau, Kaduna, Katsina, Kano and Benue. Others with high production capacity are Enugu, Ebonyi, Akwa Ibom, Oyo, Cross River, Rivers and Nassarawa. The southern part of Nigeria enjoys between 6-7 months of rainfall, with an average of 1500 mm in the rainforest Zone and > 2000 mm in the Niger Delta region (Bayelsa, Delta, Rivers, Cross River and Akwa Ibom states). In Nigeria, all agro ecological zones support cucumber production but tree crops farming is more commonly practiced in the south due to high rainfall. Many exotic vegetables are produced majorly in the Guinea and Sudan savannah agro ecological zones of Nigeria, which enjoy relatively low humidity and discourage growth of pest and diseases. Since the southern part of Nigeria enjoys bi- modal pattern of rainfall and a characteristic dry season between October/November of one year and February/March of the successive year, planting of cucumber can be practised all year round being a short duration crop of 45–55 days. Supplemental irrigation may be needed in the both south and northern parts of Nigeria are drought remains an impediment to cucumber production while excessive rainfall encourages buildup of pest and disease. States with high production capacity in Nigeria include; Plateau, Kaduna, Katsina, Kano, Benue, Enugu and Ebonyi among others.

Cucumber production in Nigeria is usually under small scale production. Although commercial (large scale) production is also practiced under plantation farming. Some factors limiting the productivity of Nigerian soils for cucumber production include low fertility, slope, poor effective depth, stoniness/high gravel content and low nutrient/moisture retention. Good agronomic practices such as regular weeding, timely irrigation, fertiliser application and prompt harvesting are necessary for the attainment of high yield and production of quality fruits.

* 1. **Plant Description**

The cucumber (*Cucumis sativus* L.) plant is a member of the Cucurbitaceae family widely cultivated for its edible fruit. In this family different types of melon such as bitter melon and squash are also included. The cucumber supposed to be native to Asia,where it has been grown for food from 3000 years. The cucumber was introduced into China in 100 B.C. and into France in the 9th century (Pal *et al*., 2020). Cucumber (*Cucumis sativus*) is a widely-cultivated creeping vine plant that bears cucumiform fruits, which are used as vegetables. There are three main varieties of cucumber. The cucumber, with large, green skin, and few or no seeds are called English cucumber. Armenian, or snake cucumbers, which are long and twisted. They are used as pickles. The cucumber plant is generally a vine with large leaves and curling tendrils. The cucumber plant may have more than five or six main stems from which the tendrils branches. The leaves arranged alternately on the vines in this plant. The flowers of the cucumber plants are yellow and about four centimeter in diameter. The fruits of the cucumber plant is a curved cylinder shaped rounded at both ends. The length of the fruits of the cucumber measures about sixty centimeters and ten centimeters in diameter. The cucumber plants are annual plants; they survive only one growing season. The vines of the cucumber plants may reach up to five meter in length. Cucumber plant may be originates from the foothills of the Himalayas, according to some studies. The cucumbers are generally a fruits but also used as a fresh vegetable and consumed also fresh in salads. Some varieties of the cucumber are grown for pickles. Yellow varieties of the cucumber are generally cooked before consumption. Cucumber (*Cucumis sativus* L.) is an important vegetable crop and having a chromosome number 2n = 14 (Pal *et al*., 2020). China is the largest cucumber producer in the world and India ranks second in the production of cucumber.

* 1. **Benefits of Cucumber**

Economically cucumbers are very important, as cucumbers contain high nutritional, medicinal as well ashealth beneficial values.

***(I) Medicinal Values***

As a member of the Cucurbitaceae family of plants, cucumbers contain high levels of bitter-tasting nutrients known as cucurbitacin which prevent cancer. The fiber found in cucumber can help to manage cholesterol and prevent related cardiovascular problems according to American Heart Association. Cucumber also contains potassium and magnesium so it reduces sodium intake and increases potassium intake may help to prevent high blood pressure. Cucumbers play a great role in diabetes. Preventing and controlling the cucumber contains substances which help to lower blood sugar and stop blood glucose from rising too high. One theory is that the cucurbitacins in cucumber help to regulate insulin release and the metabolism of hepatic glycogen, a key hormone in the processing of blood sugar. Cucumbers may have anti- inflammatory properties. Some research has suggested that cucumber’s nutrients may provide benefits for skin health. Cucumbers are a good source of potassium, magnesium and dietary fiber. These nutrients are known to lower blood pressure, thus reducing the risk of heart diseases. Research has also proved that regular consumption of cucumber juice was helpful in reducing blood pressure in elderly people with hypertension. Cucumber acts as a coolant for our stomach. The soluble fibre in cucumbers helps in slowing our digestion. Also the high content of water in cucumber makes our stools soft, prevents constipation and keeps our bowel movements regular (Chakraborty and Rayalu, 2021).

***(II) Nutritional Values***

Cucumbers have a refreshing, good taste with 95 percent water content. The cucumber helps to relieve dehydration and is good to eat in hot weather. People eat cucumber as a salad mostly. It also features in some beauty products. Staying hydrated is essential for maintaining a healthy intestine, preventing constipation avoiding kidney stone and more. Cucumber is one of the most hydrating foods and also contain with vitamin K and vitamin D, Vitamin K helps improve calcium absorption.

**Table 1: Nutrients present in each 100 gm of edible portion of Cucumber**

|  |  |
| --- | --- |
| **Nutrient** | **Amount per 100gram** |
| Carbohydrates | 2.6gm |
| Protein | 0.6gm |
| Calcium | 18gm |
| Thiamin | 0.02mg |
| Energy | 12calorie |
| Riboflavin | 0.02mg |
| Iron | 0.2gm |
| Vitamin C | 10mg |
| Niacin | 0.01mg |

(Source: Rashid, 1999)

***(III) Health beneficial values***

All that water in cucumbers can help keep us hydrated. Plus, the fiber gives us helps to stay regular and avoid constipation. The vitamin K helps blood clot and keeps ours bones healthy. Vitamin A has many benefits, like helping with vision, the immune system and reproduction. It also makes sure organs like our heart, lungs and kidneys to work properly. Cucumbers contain magnesium, potassium, and vitamin K. The three nutrients above are vital for the proper functioning of the cardiovascular system. Potassium and magnesium can lower the blood pressure. The cucumber if eat in regular basis it has been found to decrease bad cholesterol and blood sugar levels as well. Cucumber also contains a range of vitamin A, B vitamins, and antioxidants, including a type known as lignans. Antioxidants help to remove free radicals from the body. Generally free radicals come from natural bodily processes, and outside pressures such as pollution. The free radicals If collected large amount in the body, they can l damage the cell and caused various types of disease. The lignans found in cucumber and other things help to lower the risk of cardiovascular disease and many types of cancer. The cucumbers can also increase the beauty and have good effects on the skin. The juice of cucumber when apply on skin makes it soft and glowing. Cucumber regulates hydration and maintains blood pressure and sugar, soothes skin, helped in digestion, reduces fat and help to weight loss (Chakraborty and Rayalu, 2021).

* 1. **Agronomic Properties of Cucumber**

After transplanting, cucumber can be grown as monocrops or as intercrops with other arables or with citrus seedlings (Olaniyan and Fagbayide, 2006), *Carica papaya (*Olubode *et al.,* 2014*)*. In intercropping Cucumber with other crops like Pawpaw. It is important to introduce the cucumber before the time of flowering for better nutrient use efficiency by the cucumber (Olubode, 2012). Delayed introduction reduces vigour (Ajayi, 2020). Staking is very necessary on the field in order to improve yield. According to Modupeola *et al.,* (2016), staked cucumber performed better than unstaked cucumber. Intrarow spacing of 50 cm -100 cm is recommended (Yaduma *et al.,* 2020). Pruning is also required as it helps to increase light penetration in the farm and reduce build-up of pest and diseases. A spacing of 50 cm × 50 cm is recommended for cucumber cultivation in Nigeria. With pruning, a yield of 571.87 kg/ha was obtained while no pruning produced a yield of 301 kg/ha as spacing of 50 cm × 50 cm gave yield of 581.59 kg/ha. At 50 cm × 100 cm yield obtained was 291.78 kg/ha while 100 cm × 100 cm spacing produced 437.04 kg/ha (Akinpelu *et al.*, 2011).

**2.5.1 Pest and disease management**

Pests and diseases which affect cucumber production in Nigeria include Cucumber mosaic virus, Downy mildew (Akinpelu *et al.,* 2017). The variety and type of agrochemical used has strong influence on the reduction of insect pest infestation and severity (Pitan *et al.,* 2013). Control measures include manual weeding, chemical and physical control measures. These include farm hygiene, manual eradication (depending on farm size) and use of chemicals. Weeding can be done 2–3 times before harvest. Inadequate weeding frequency affect yield significantly through yield decline (Mbah *et al.,* 2011). It can also serve as weed control if planted as an intercrop. On the other hand, intercropping of cucumber with Turmeric and Ginger can suppress Cucumber Mosaic Virus while *Solanum torvum* and *Tithonia diversifolia* can suppress nematodes in cucumber (Kayode *et al.,* 2020; Izuogu *et al.,* 2017). *Hyptis suaveolens* and *Centrosema pubsecens* extracts can also be used for control of cucumber beetles (Yussuf *et al.,* 2017).

**2.5.2 Irrigation**

Supplemental irrigation may be needed from time to time depending on available soil moisture. According to Emeghara *et al.,* (2013), 20% water deficit is recommended for cucumber production. Mulching is also an excellent practise to help conservation of soil water (Haruna *et al.,* 2013). Under greenhouse conditions, 12.9 L of water is adequate (Awobona *et al.,* 2020). Different methods used for irrigating cucumber in Nigeria include sprinkler and drip irrigation. Others are use of watering can (small scale production). In most cases, production of cucumber is under rainfed condition. Irrigation during flowering needs to be done with caution to avoid flower abortion. Irrigation in small scale cucumber farming is recommended in the early hours of the day or evening time to avoid high loss of moisture due to evapotranspiration.

* + 1. **Soil Requirement**

Nigerian soils show great variability in their properties; from the acid sands of sedimentary rock formation to the basement complex soils and coastal plain sands. pH varies from very acidic (<5 to >7). Constraints include sandiness, shallow depth, acidity (top and sub soil), and low fertility among others. The soils have high base saturation but relatively low to medium effective cation exchange capacity and Total exchangeable bases. Proper management is needed to attain sufficiency in cucumber production. Soil management is the meticulous use of soils through effective and timely combination of factors and practices which can improve soil quality and increase yield (Awobona *et al.,* 2020). It can be further defined as various activities carried out on the soil to improve and sustain it for optimal productivity in order to enhance food, fibre and timber production. Many agricultural practices affect cucumber producing soils. These include practices such as tillage and planting operations, irrigation, fertilizer application and use of agro chemicals for pest and disease control. Adequate soil management involves the use of soils for purposes for which they are most suited (Babatola, 2016). Requirements for good Soil management includes understanding soil capability for cultivation of various crops, management of problems associated with soils, such as pH, water, fertility and temperature. Problems associated with soil management of Nigerian cucumber soils include inadequate soil survey classification and fertility assessment, lack of communication between land users and government on soil information, absence of conservation practices in farming (Akamigbo and Nnaji, (2011).

a. **Organic sources:** Farmyard manure e.g. poultry manure, cow dung, compost, household waste are good sources of fertiliser for cucumber. Others are poultry manure and pig manure (Adebiyi *et al.,* 2017). Application rate of 5-6 t/ha poultry manure is recommended in the Northern Guinea savannah of Nigeria, 35 NPK 400 g/N/ha), recommended 5 t/ha in the inland valley, of SWN and 10 t/ha for upland soils (Bamikole *et al*., 2011; Anikwe, 2011). For the arid zones, 120 kg/ha Poultry Manure is adequate, while 80 kg/ha cow dung is suitable (Dantata, 2008). Other soil fertility improvement option includes; the use of cassava peel and use of organo mineral fertiliser, 20 t/ha PM is suitable in Kano (Yaduma *et al.,* 2020).

b. **Inorganic sources:** NPK, Urea, Phosphate and potash. 50-60kgNPK/ha is recommended for the Northern guinea savannah zone (Anikwe, 2011). According to Adebayo and Akintoye, (2007), cucumber production in Nigeria requires 130 kg/haN, 95 kg/ha P2O5 and 200 kg/ha K2O. It is however important to note that fertiliser application should be based on soil test results. Fertiliser should be best applied at 3–6 WAP (Odeleye and Adedokun, 2006).

c. **ISFM**: Integrated soil fertility management is considered most appropriate for management of cucumber producing soils of Nigeria. ISFM strategies that can be used to manage soil fertility problems in cucumber production in Nigeria include use of appropriate farming systems and planting of companion crops such as marigold to suppress soil pathogen timely and adequate application of fertilisers, use of cover crops and mixed cropping to allow organic matter accumulation, use of organic manure, compost and organo mineral fertiliser, adequate irrigation to help soil processes, crop rotation. Integrated soil fertility management is the best approach to managing soils under cucumber (Abdulkadir *et al.,* 2020).

* 1. **Constraints Affecting Cucumber Production**

Due to the inherent low fertility status of many Nigerian soils and poor availability nutrients for plant growth. Cucumber producing soils hardly have sufficient nutrients for plant needs and optimal productivity of crops. Proper soil fertility is necessary as vine length, and other growth parameters affect the eventual crop yield. Therefore, timely and appropriate application of fertilizer is required to improve yield and reduce nutrient mining and soil degradation. Organic or inorganic fertilisers are mainly used for combating soil fertility problem in cucumber production. However, there is strong advocacy for use of integrated soil fertility management (ISFM). Although fertilisers have the potentials to increase yield, there is need for caution as high fertiliser rates could also affect fruit quality (Abdulkadir *et al.,* 2020). Use of organo-mineral fertilisers is highly recommended as they more compatible with the nature of our soils due to their slow release pattern and environmental friendliness considering the high sand content of Nigerian Cucumber producing soils.

* 1. **Types of Fertilizers**

There are different types of fertilizers that are mentioned below:

**Inorganic Fertilizers:** Inorganic fertilizers are chemical fertilizers that contain nutrient elements for the growth of crops made by chemical means. The inorganic fertilizers are of the following types:

**Nitrogen Fertilizers:** Nitrogen fertilizers contain nitrogen necessary for the development of crops. Nitrogen is the main constituent of chlorophyll that maintains a balance in the process of photosynthesis. It is also a part of amino acids in plants and constitutes protein. Nitrogen fertilizers improve the production and quality of agricultural products (Abdulkadir *et al.,* 2020).

**Phosphorus Fertilizer:** The main nutrient in a phosphorus fertilizer is phosphorus. The efficiency of fertilizer depends upon effective phosphorus content, methods of fertilizing, properties of soil and crop strains. Phosphorus found in the protoplasm of the cell plays an important role in cell growth and proliferation. The phosphorus fertilizer is beneficial for the growth of roots of the plants (BIOFECTOR, 2017).

**Organic Fertilizers:** Organic fertilizers are natural fertilizers obtained from plants and animals. It enriches the soil with carbonic compounds essential for plant growth. Organic fertilizers increase the organic matter content of the soil, promotes the reproduction of microorganisms, and changes the physical and chemical properties of the soil. It is considered to be one of the main nutrients for green food (Orluchukwu and Amadi, 2022).

Organic fertilizers can be obtained from the following products: Agricultural Waste, Livestock Manure, Industrial Waste and Municipal Sludge

* 1. **Roles of Fertilizers in Crop Production**

Every living organism requires nutrients for their growth and other metabolic activities. For their survival, they follow a mode of nutrition (Abbasi *et al.,* 2015). We humans and animals depend on plants for nutrients. Plants have an autotrophic mode of nutrition where they prepare their own food and obtain their nutrients via photosynthesis (Hartmann *et al.,* 2004). The soil is not fertile enough to provide essential macro and micronutrients to plants in sufficient quantity. Hence they need another source of nutrition. Manures and fertilizers are the alternatives used in agriculture for this purpose (Outhman and Lamma, 2020). Manures are the natural source of nutrients obtained from cow dung, leaves, human excreta, and other wastes. Fertilizers are commercial products available in different forms like solid, gas or liquid. Both manure and fertilizers contain salts and organic chemicals which consist of essential plant nutrients such as nitrogen, potassium, phosphorus in known concentrations (Lamma, 2021). It is very difficult to meet the demands of the increasing population with such fewer resources. Loss of soil fertility, pests, and lack of nutrients has resulted in a decrease in agricultural production. This has increased the importance of fertilizers in agriculture. Since the chemical fertilizers adversely affect soil fertility, biofertilizers were brought into use. These are substances that contain living or latent cells, and even micro-organisms. They provide the soil with the necessary nutrients and microbes for the growth of the plants. They help the soil to retain its fertility. They are environment-friendly and also destroy pathogenic components responsible for causing disease in plants. Acetobacter and Rhizobium are two such widely used biofertilizers. Fertilizers increase plants’ tolerance towards pests. This has reduced their reliance on insecticides and herbicides, thereby, producing healthier crops. Consequently, diseases have reduced, providing aesthetic value to the crops. Fertilizers improve the water holding capacity of the plants and increase root depth. The potassium content present in the fertilizers strengthens the straws and stalks of the plants. The phosphorus present in the fertilizers helps in the faster development of roots and formation of seeds in the plants. Nitrogen in the fertilizers enhances the growth of the plants which can be characterized by the green colour of the plants.

* 1. **Effect of Organic and Inorganic Fertilizers on Cucumber Growth and Yield**

Okee *et al.,* (2020) examined the effect of organic manure (saw dust, poultry manure and cow dung) on growth and yield of cucumber. The experiment was conducted at Kogi State University Nursery Farm during the 2020 dry season. The experiment was laid in a randomized complete block design with 4 treatments and five replications. Four rates of well decomposed cattle manure levels (0t ha-1, 5 t ha-1, 10t ha-1, and 20t ha-1) were used. Organic matter content, soil pH, soil texture, inherent N, P and K for the four soil types and nutrient quality for manure were evaluated prior to crop establishment. Cattle manure, poultry droppings and saw dust were analysis for its nutrient composition (0.95% N, 0.17% P, 0.63% K, 1.52% Ca, 4.7% Zn and a pH of 6.7) before application. This trial clearly indicated that production of cucumber can be enhanced by combined application of poultry manure. Farmers are therefore advised to use the highest rate of combined application of 10,000 kg/ha of poultry manure. They proved to be effective in supplying the required nutrients for growth and yield of cucumber crop.

Orluchukwu and Amadi, (2022) studied the effects of organic and inorganic fertilizers on the growth and yield of cucumber (*Cucumis sativus* L). The research was done in a randomized complete block design with four treatments and replicated four times. The treatments include control (no application), NPK 15:15:15, spent mushroom substrate, and poultry manure. Results showed that plots with poultry manure had significant effect on vine length, number of leaves, leaf area at 6 weeks after planting (WAP) and 8WAP. The highest number of fruits was 9.0 per plot or 15,000 per hectare and highest fruit weight was 1.59kg/plot (2,650kg/ha) which were higher than NPK 15:15:15 (0.47kg/plot or 783.33kg/ha) and spent mushroom substrate (0.19kg/plot or 316.67kg/ha). Hence, they recommended the use of poultry manure as organic source for the cultivation of cucumber**.**

Adnan *et al.,* (2017) evaluated the effect of integrated use of mineral and organic nitrogen sources (farmyard manure) on maize yield, nitrogen uptake and soil fertility was assisted in the field experiment carried out on silty clay loam soil. Combined doses of Nitrogen provided from all sources was applied 150 kg.ha-1. There were four replications and 6 treatments i.e., (T1) Control, (T2) 150 kg N ha-1 from mineral sources, (T3) 150 kg ha-1 from FYM, (T4) 25% FYM + 75% mineral N, (T5) 50% FYM + 50% N and (T6) 75% FYM + 25% mineral N. Maize variety (Azam) was sown in RCB design. Data on plant height, grain yield and stover yield were recorded in maize. Samples of grain and stover were analyzed for total N to determine its uptake by the crop. Results indicated that the greatest plant height of 221.85 cm, maximum grain yield of 2046.12 kg.ha-1 and straw yield of 7004.73kg.ha-1 were obtained from treatment 25% N was applied from farm yard manure and 75% of mineral fertilizer. Agronomic efficiency and nitrogen use efficiency were also found higher in the treatment 25% N were applied from farm yard manure and 75% from mineral fertilizer. Soil total N, organic matter and available P were significantly affected by the organic source and there integration with mineral N source. Maximum total N, organic matter and available P were observed in treatment where FYM were applied alone. It was concluded that combination of organic and mineral N sources in ratio 25:75 are the best combination to achieve sustainable yield and soil fertility.

Makinde E. and Ayoola O. (2010) reported high and sustainable crop yields in the tropic to be only possible with judicious combination of mineral fertilizers and organic amendments. The growth and yield of maize cultivated with a complementary application of organic and inorganic fertilizers was assessed compared with sole organic and sole inorganic fertilizers, in the degraded tropical rain forest zone. There was a no-fertilizer treatment as the control. The organic fertilizer was an equal mixture of composted domestic waste and stale cow dung, applied at 10 tonnes ha-1. Urea and Single super phosphate were applied as the inorganic fertilizer to supply 70 kg N and 13 kg P2O5 ha-1 respectively. The mixture of organic and inorganic fertilizer treatment consisted of half the rates used for sole organic and sole inorganic fertilizer treatments: 5 tonnes organic mixture was applied, with 35 kg N and 6.5 kg P2O5. Maize plant height at 8 weeks after planting was highest with inorganic fertilizer application while the leaf area was highest with organic fertilizer application. Stover yield and cob yields were also highest with inorganic fertilizer. Complementary application of organic and inorganic fertilizers however had similar plant heights; stover yield as well as cob yields with inorganic fertilizer. Nitrogen appeared chelated with organic fertilizer application. Plant ear – leaf Nitrogen was highest (1.68%) with inorganic fertilizer while the control plots had a Nitrogen content of 1.12% which was higher than 0.84% and 0.98% N from sole organic and a complementary application of organic and inorganic fertilizers, respectively. Plant P content was increased by 136% and 15% with organic and inorganic fertilizers, respectively, but was reduced by 15% with complementary application of organic and inorganic fertilizers. The K content was highest with inorganic fertilizer (1.91%). Complementary application of organic and inorganic fertilizers had a K content of 1.70% while the organic – fertilized leaves had 1.53%. Stover nutrient uptake was highest for N and K with inorganic fertilizer while the P was highest with organic fertilizer application. Cultivating maize with complementary organic and inorganic fertilizers gives a comparable cob yield as inorganic fertilizer and has nutrients higher than from sole organic fertilizer application.

Al-fehaid *et al.,* (2022) carried out a study to investigate the effect of chemical, organic and bio- fertilizers on growth, yield and quality of cucumber crop. Five treatments of fertilization (chemical "inorganic") as a control – (organic) – (organic + Biochar) – (organic + fungus “VA-mycorrhiza”) – (organic + bacteria “Bacillus”) were used in this study. Results revealed that there were significant differences between the fertilization treatments in all studied characteristics except leaf fresh weight (g), fruit length (cm), number of fruits plant-1 and total soluble solids (%). The results showed that the organic with bio fertilizers gave the best results in all studied characteristics and were not significantly different from chemical (inorganic) fertilization. Fertilization treatment (organic + bacteria) was the best in yield and quality characteristics. Fertilization treatment (organic + fungus) was the best in some vegetative growth traits such as relative growth rate (g g-1 day-1) and net assimilation rate (g m-2 day-1). Therefore, the study recommended the use of organic fertilizers with bio fertilizers, especially (organic + bacteria) to obtain the highest yield and quality of cucumber fruits.

Tahir *et al.,* (2019) conducted a study to determine the effects of Organic and Inorganic Fertilizer on the growth and yield of *Cucumis sativus* L. Four (4) days after transplanting, a rate of 2ton/ha, 4ton/ha, 6ton/ha poultry manure was applied. Similarly, a rate of 25g/ha, 50g/ha, 75g/ha of NPK was also applied and a control. Highest plant height of 33cm was recorded with 6ton/ha compared to the control which had 11.5cm. However, highest number of leaves was recorded with 4ton/ha and was followed by the 6ton/ha. The best stem girth of 1.8cm, was observed with 4ton/ha while the control had 0.88cm stem girth. Excellent vigour was produced by the 6ton/ha, while the lowest vigour was observed with the 2ton/ha. The best plant yields of was observed with 6ton/ha compared with the control which had the least performance. On the other hand, 25kg/ha of NPK had the highest plant height of 20.5cm while the lowest plant height of 13cm was observed with 75kg/ha, compared to the control which had 11.5cm. The 25kg/ha gave the highest number of leaves followed by the 50kg/ha and 75kg/ha which both had the lowest number of five (5) leaves. Similarly, 50kg/ha had the highest stem girth of 1.2cm while the lowest stem girth was observed with the control which had 0.7cm stem girth. The best vigour was recorded with the 25kg/ha compared to the control which had the least vigour. Also, highest plant yields was recorded with 25kg/ha and the lowest plant yield was observed in the control. The application of poultry manure in the propagation of *Cucumis sativus* remarkably influenced the growth and yield of Cucumber in this study.

Alarima *et al.,* (2022) examined the appropriate crop variety and organic fertilizer rate as factors that impact growth and yield of cucumber *(Cucumis sativus L).* There were four organic manure rate treatments comprising 0, 5, 10, and 15 t.ha-1 of Gateway Organic Fertilizer brand. The three cucumber varieties investigated were: Marketmore, Poinsett and Marketer. From the study, Gateway Organic Fertilizer application had positive influence on growth and fruit yield of cucumber. Number of leaves, number of branches and vine length increased with increasing organic fertilizer rate. Yield was increased up to 53.63 %, 64.74 % and 51.65 % with Marketmore, Poinsett and Marketer varieties, respectively. Among the varieties, Poinsett variety was best for optimum growth and yield. Application of 10 t.ha-1 Gateway Organic Fertilizer was optimum for fruit yield of cucumber.

Marliah *et al.,* (2020) carried out a study to determine the effect of combine organic fertilizer (manure) and inorganic fertilizer (NPK and Micro fertilizer) on the growth and yield of cucumber (*Cucumis sativus* L.). This experiment was arranged in a factorial randomized completely block design with two factors and three replications. The first factor was the provision of organic fertilizer (manure) with 3 levels: 10 t ha-1(K1), 20 t ha-1 (K2), and 30 t ha-1 (K3). The second factor was the provision of inorganic NPK fertilizer with 3 treatments: Without NPK fertilizer (control - N0), NPK Fertilizer (N 50 kg ha-1, P2O5 50 kg ha-1, and K2O 50 kg ha-1 (280 kg ha-1Phonska 16-16-16 - N1), and NPK + Micro Fertilizer (N 50 kg ha-1, P2O5 50 kg ha-1, and K2O 50 kg ha-1 (280 kg ha-1Phonska 16-16-16 + 2% Micro fertilizer – N2)). Results show that organic fertilizers (20 and 30 ton ha-1) increase fruit weight of each sample and fruit weight of each plant. The application of NPK + Micro Fertilizer produces in the best fruit weight of each sample and fruit weight of each plant. The combination of organic fertilizer (20 ton ha-1) and inorganic NPK + Micro Fertilizer results in the best fruit weight each plant of cucumber.

From these studies, there is need to further examine the use of Organic and inorganic fertilizers to ascertain its effect on *Cucumis sativus* growth and yield response.

**CHAPTER THREE**

**MATERIALS AND METHODS**

**3.1 Site Description**

The research was conducted at the Teaching and Research Farm of the Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus in Oruk Anam Local Government Area, Akwa Ibom State. The Teaching and Research farm in Obio Akpa lies between latitude 4030S and 5030N and longitude 70 30W and 80 00E (SLUS-AK, 1989). The area has a mean annual rainfall ranging from 2000mm to 2600mm with bimodal pattern, which peaks in June and October (SLUS-AK 1989).

**3.2 Soil Analysis**

Soil samples was collected at random from the site at a depth of 0-15cm using soil auger. The samples were carefully packed and labeled in polythene bags and taken to the laboratory for soil physicochemical analysis.

**3.3 Experimental Design and Treatment**

The experimental design used was randomized complete block design (RCBD) with four treatments. Each treatment was replicated six times and the treatment will comprise of poultry manure, goatery manure and NPK inorganic fertilizer with a control treatment.

**3.4 Experimental Plot Site**

The experimental area was measured 25m by 17m giving an experimental area of 425m2 with a planting distance of 75cm by 75cm. There were 4 treatment plots (including control) with 6 replication with a plot size of 3m by 3m demarcated from one another by 1m apart.

**17m**

**Control Poultry Goatry NPK**

**3m**

**3m 1m apart**

**25m**

**3m**

**Figure 1: The Layout of the Experimental Treatments and Design**

**3.5 Agronomic Practices**

* **Land Preparation**

The field was prepared by clearing with the use of machetes. This was followed by bed making after marking out of the plots with tape, ropes and pegs.

* **Planting, Weeding and Fertilizer Application**

Seeds of cucumber was planted in the treatment plots by direct sowing in the already prepared beds in the field at the spacing of 75cm by 75cm. The organic manures were applied uniformly to the plants before the actual planting. This was done by mixing the top soil with the measured quantity of the organic manure into the hole before planting. Weeds was removed manually and at interval as they as they emerged.

* **Harvesting**

The cucumber fruits were harvested after 1 month 2 weeks after planting on weekly basis.

**3.6 Data Collection**

Percentage germination, growth and yield parameters data was collected as shown below;

* **Percentage germination (%)**

The percentage germination was taken 5 days after planting and calculated based on the total number of seeds planted. The established numbers of stands were expressed in percentage.

* **Growth Parameter**

The assessment of the growth performance of the tagged crops was done at three-week interval. The tagged plants were randomly selected from each treatment plot for measurement. The growth parameters considered will include:

1. **Number of Leaves**

The number of cucumber leaves was determined by physical counting of all functional leaves per plant at 3 weeks’ interval after planting and recorded per treatment plots.

1. **Vine girth (cm)**

The vine girth was determined using a measuring tape to measure the girth of the tagged plants.

1. **Vine length (cm)**

The vine length was measured using a measuring tape to measure the length of the vine from the base to the top of the growing plant. This was expressed in centimeters.

1. **Number of vines**

The number of vines was determined by physical counting of all the vines per plant at 3 weeks’ interval after planting and recorded.

* **Yield Parameters**

The assessment of the yield parameters of the tagged crops was done at 1 month and 2 weeks after harvesting. The harvested plants were selected at random from each treatment plot for measurement. The yield parameters considered will include:

1. **Number of fruits/Plant**

The number of fruits/Plant was determined by counting the fruits on each tagged plant selected for data collection.

1. **Length of fruits (Cm)**

This was determined using a ruler and the values carefully recorded.

1. **Circumference of fruits (cm)**

The circumference of the cucumber fruits was determined by dividing the fruits of the tagged plant into two halves and the measurement of the circumference was done using tape rule.

1. **Weight of Cucumber per plant (t/ha**)

The weight of the cucumber fruits harvested per plant was determined using a weighing balance and the value recorded from the tagged plants.

1. **Yield of Cucumbers (t/ha)**

Cucumber yield was determined by adding the weight of cucumber fruits of tagged plants and expressed in tonnes per hectare.

**3.7 Data Analysis**

The experiment was carefully monitored and data on the growth and yield parameters collected and recorded for analysis. The data collected from the study was subjected to analysis of variance (ANOVA), and the treatment means was separated using Least Significant Difference (LSD) at 5% level of probability.

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