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EVALUATION ON THE EFFECT OF SUSTAINABLE ENVIRONMENTAL FRIENDLY POULTRY DROPPINGS (ORGANIC MANURE) ON THE YIELD OF MAIZE *ZEA MAYS* PRODUCTION IN THE NIGER DELTA AREA (BAYELSA STATE) OF NIGERIA

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ABSTRACT

Evaluation on the Effect of Sustainable Environmental Friendly poultry dropping on the yield of Maize (*Zea mays*) production in the Niger Delta Area (Bayelsa State of Nigeria'' was evaluated at the Niger Delta University Teaching and Research Farm Amassoma, 2016 planting season. The design used in the study was Randomized Complete Block Design (RCBD). Data collected were subjected to Statistical Analysis of Variance (ANOVA) on the following parameters; maize plant height, leaf area, number of plant nodes and inter nodes, cob length and girth, number of kernel row per cob, weight of 1000kernels of maize and yield of maize in tons (t/h). The results obtained from weight of 1000 kernels and maize kernel yield shows that there was a significant difference between the treatments assessed when compared with the untreated plots. For the weight of 1000 kernels, the results, shows that C and D are significantly higher than the other treatments with mean values of 203.50g and 209.50g respectively at P=0.05. With regards to maize kernel yield, treatment C (15t/ha) and D (20t/ha) of poultry droppings shows the highest yield with a mean value of 0.8t/ha at P=0.05 when compared to other treatments, while the untreated plots which serves as the control (0t/ha) had the least yield of 0.50 t/ha at P=0.05

Key words; plant height, leaf area, number of plant nodes and inter nodes, cob length and girth, number of kernel row per cob, weight of 1000 kernels of maize and yield of maize in tons (t/h).

Agriculture is known from the beginning on the creation of man on earth as it was recorded in the Holy Bible during the stone age of Adam and Eve for the purpose of planting crops and rearing of animals all geared towards production of food and feed for man and its livestock and raw materials for industries for manufacturing of finished or end products. Food supply in agriculture is closely related to food security which is defined as the availability of food and its by-products at all times of adequate world food supplies of basic foodstuffs to human beings to sustain a steady expansion of food consumption and to offset fluctuations in production and prices in the chain of food distribution. Food security exists when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life for the teeming population in the Global World. Food insecurity, on the other hand, is a situation of "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable quality of food and its bye products. To achieve high production quality and healthy food products, agriculture should, focussed on Organic Farming system (Derven Daphane L. 2003). Presently, the Global World is focussing on sustainable crop production which is the Organic Farming System.

Organic Agriculture is an **evolutional** production system that sustains the health of soils and its microbes, ecosystems and people. Organic Agriculture relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of synthetic inputs that will result to adverse environmental effects particularly on pollution. Therefore, Organic farming is a form of agriculture that relies on sustainable cost effective techniques to enhance the natural fertility of the soil, these techniques includes crop rotation, companion planting, biological pest control, with a recent bio-pesticide invention invented by Dr. Azawei Alamene, 2019 named Alamicide Bio-pesticide and naturally-sourced fertilizers such as compost, farm yard manure, green manure, and bone meal. It is a system that begins to consider potential environmental and social impacts by eliminating the use of chemical inputs, such as synthetic fertilizers and pesticides, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation. These are replaced with sustainable site-specific management approach that is a practice, that involves the use of natural pesticides like Alamicide Bio-pesticide and Bio-fertilizers such as pyrethin found naturally in the Chrysanthemum flower an example of another natural pesticide that maintained and increased long-term soil fertility and prevent pest and diseases. These measures used the natural environment to enhance agricultural productivity.

Animal manure or poultry dropping is an organic fertilizer consisting of partly decomposed mixture of dung and urine. Manure from either plant materials or animal droppings are recognized as a key resource in sustaining soil fertility in the tropics, supplying the soil with a range of macro-and micro-nutrients and organic matter (Defoer *et al*.,2000).

Organic manure such as poultry dropping when properly decomposed into the soil, gives humus which do not only provide plant nutrients and a fertile soil, but also does a number of insignificant processes which includes good root developments, nutrients recycling, improvement of water holding capacity of the soil, improvement of soil texture, structure and improvement of soil aeration capacity.

Contrary to organic farming, and inorganic farming involves the use of synthetic fertilizers such as nitrates, urea, phosphate etc. These fertilizers are not environmental friendly and are hazardous to human health and other organisms. The rising cost of inorganic fertilizer coupled with their inability to condition the soil has directed attention to the use of organic manure in recent times in the Globe.

Maize plant is one of nature's most important energy storing plant and also a major source of starch. It is an essential tropical crop which serve as raw material for young industries for manufacturing and production of, foods, from crop for human consumption. Like many other regions in the World, it is consumed as a vegetable, although it is a grain crop. The grains are rich in vitamins A, C and E, carbohydrates, and essential minerals, and contained 9% protein. They are also rich in dietary fibre and calories which are a good source of energy for both human and livestock, because of its vital role it played in the food chain, makes nature, to make it high in demand for sustainability for crop production.

Considering the magnitude of advantages organic fertilizer, has comparative advantages over inorganic fertilizer, a decision was made to carry out a practical research on the application of organic Poultry droppings on maize plant in the Niger Delta Teaching and Research Farm. This gave rise to the topic "Evaluation on the effect of Sustainable Environmental Friendly poultry dropping on the yield of Maize *Zea mays* production'' and the critical growth stages in relation to water requirement.

Organic fertilizer, particularly poultry dropping has been proven over the years in the Global World to improve soil fertility in various ways, which in turn increased the yield of agricultural farm produce without causing harm to the environment (no form of atmospheric pollution and pollution of water bodies). It is cost effective and is also readily available for use by both commercial and subsistence agriculture.

Therefore, this experiment was evaluated as a baseline study to determine which rate of poultry dropping amongst the selected rates gives the best result in terms of growth and yield of maize grains production.

The objectives of this study are to: to ascertain the effect of poultry dropping is suitable for maize production in Niger Delta University Teaching and Research Farm land and to evaluate the rate of poultry dropping that gives the best result in relation to the growth and yield of maize.

Maize originated from a single domestication in Central America, particularly in Southern Mexico and is the most widely cultivated grain crop and also the most widely consumed staple food in several regions of the world. *Zea mays* commonly known as corn in some regions in the Globe is a genus of the family Graminae (Poaceae), is a cereal crop that that belong to the great grass family which is grown widely throughout the world in an agro-ecological environment. It is a tall, monoecious annual grass crop with overlapping sheaths and broad blades. Maize plants have staminate spikelet's in long spike-like racemes that form large spreading terminal panicles (tassels) and pistillate inflorescences in the leaf axils, in which the spikelet's occurred in 8 to 16rows, approximately 30cm long on a thickened almost woody axis known as cob. Maize is wind pollinated and also for both self and cross pollination.

Maize is cultivated worldwide and represents a staple food for a significant proportion of the world's population. No significant native toxins are reported to be associated with the genus *Zea* (International Food Biotechnology Council, 1990). Research conducted by other scientists shows that maize is grown from 58ºN to 40ºS, from below sea level to altitudes higher than 3000m, and in areas with 250mm to more than 5000mm of rainfall per year (Shaw, 1988) and with a growing life cycle ranging from 3 to 13 months (CIMMYT 2000).

Importance and Uses of Maize

Maize is a staple food, had an estimated value of 50% of the population in the Global World that depended on it and provides 50% of the basic calories for human and livestock consumption. It is an important source of carbohydrate, protein, iron, vitamin B and minerals. Maize grains have great nutritional value as they contained 72% starch, 10% protein, 4.8% oil, 8.5% fibre, 3.0% sugar and 1.7% ash (Chaudhary, 1983). India has 5% of maize acreage and contributes 2% of world production. Maize is the world's top ranking food crop followed by wheat and rice. In India, it is the third most important cereal after wheat and rice. In India, about 28% of maize produced is used for food purpose, about 11% as livestock feed, 48% as poultry feed, 12% in wet milling industry (for example starch and oil production) and 1% as seed for planting (AICRP on Maize, 2007). Maize is used for manufacturing of industrial products such as plastics, fabrics, adhesives and ornamentals and also used for the production of bio-fuel.

Soil Condition Necessary for Maize Production

Maize thrives in a well-drained sandy loam soil with a pH of 5.7-7.5 and 500-800mm of rainfall evenly distributed throughout the growing season for good yield. Due to the shallow nature of the root system, maize plant is solely dependent on soil moisture. Maize does well on most soils, but less so on very heavy dense clay and very sandy soils. The soil should preferably be well-drained as the crop is susceptible to water logging.

Organic Manure (Poultry Droppings)

Organic Matter (OM) is been considered as the life wire of soil as well as a storehouse of plant nutrients (Reddy and Reddi, 1992). It played an important, roles in maintaining soil fertility and productivity. Organic matter acts as a good source and reservoir of primary, secondary, and micro nutrient elements for crop production, also preventing leaching of these soil-plant nutrients. Manure is also an important source of humus and has a beneficial long-term effect on the structure and carbon-economy of the soil. It also improves the cation exchange capacity (CEC) of soil texture and structural properties (Buckman and Brady, 1980).

Poultry dropping is a kind of organic manure gotten from poultry waste consisting of poultry faeces, urine, spilled feed, feathers and materials used as bedding (wood shavings or sawdust) in poultry operations. Poultry manure as an organic fertilizer is used especially for soil that is low in Nitrogen: which is a prerequisite for green leafy growth of maize. Basically, poultry manure has a higher total solid content than most other types of manures from animal species such as swine, beef, turkey, etc. and is considered a rich source of organic fertilizer for crop production; poultry manure has the highest amount of nitrogen (N), phosphorous (P) and potassium (K) content of soil improvement. Besides fertilizing crops like Nitrogen fixation from poultry manure also supplied other essential plant nutrients, lower soil bulk density, increases the water holding capacity, improves soil structure, improves soil aeration, improves soil infiltration and serves as soil amendment by increasing organic matter content, which helped to improve the soil's moisture content and nutrient retention. The pH of poultry manure varies according to its age, the age of birds, the feed fed to birds and the bedding material used played significant role in maintaining soil fertility. Poultry manure Soil pH ranges mostly from 6.5-8.0, being neutral or moderately alkaline.

According to Camberato *et al.* (1996) and Fulhage (2000) the nutrient content of manure varies widely with animal species, age, ration quality and feed consumption, as well as with different storage methods, of handling stored manure in terms of, housing type, temperature and moisture content, treatment and land application. According to Fulhage (2000), Poultry manure contained the three major plant nutrients: nitrogen, phosphorus and potassium (NPK), as well as many essential nutrients such as Ca, Mg, S, Zn, B, Cu, Mn. In addition to supplying plant nutrients, Fulhage (2000) further explained that, manure generally improves soil tilth, aeration, and water holding capacity of the soil and promotes growth of beneficial soil micro-organisms or microbes. Manure applied in the proper amounts at the appropriate time can supply some, if not all, of the nutrient requirements of many crops. Phosphorus is one of the major limiting factor of plant nutrients and its deficiency has a major significant constraint for better crop production in most of the tropical soils (Tchienkova and Zech, 2003). Nitrogen and available P are the most deficient plant nutrient elements in Nigerian soils (Ayeni, 2012). The deficiency of P primarily occurs as a result of shortage of inherent soil P, depletion of soil P by crop removal, absorption and fixation of P with Fe and Al oxides and hydroxides (Solomon and Lehmann, 2000). In animal manure management, P is the nutrient of major concerned on Tropical soils with high P fertility levels (Johnson and Eckert, 2009). Phosphorus applied to fields as manure or commercial fertilizer can moved into bodies of water during erosion and runoff events, and is largely responsible for the accelerated eutrophication of many bodies of water (Johnson and Eckert, 2009). Phosphorus leaching from soils with elevated P levels due to manure applications is increasingly becoming a concern as a source of eutrophication of streams and lakes (Lehman *et al*., 2005).

Poultry manure has been shown to be a safe and valuable organic fertilizer source for agricultural crop production. Poultry manure provides soil-plant nutrient content of Nitrogen Phosphorus, Potassium as well as other minerals needed for plant uptake. In addition, poultry manure also provides many other benefits to improve soil biology, physical, and chemical properties and also prevent soil erosion, especially after long time land application. Many studies have shown that using poultry manure over a long period of time would change the biological and chemical properties of the soil with the increase of soil organic matter (Tejada *et al*., 2006) Soil organic matter content supplied from poultry manure affects greatly the physical condition of the soil such as runoff, infiltration, water retention capacity, soil pH and so on (Hillel, 1998). Moore and Edwards in 2005 investigated the long-term effects of alum treated poultry litter and normal poultry litter manure on soil fertility and found that both treatments increased soil pH value from (5.1 to 5.3) in the beginning to (5.8 to 6.5) at the end of the experiment; thus, this decreased the exchangeable Al toxicity when compared to unfertilized (control). In this study, the authors also observed the decrease in soil pH linear with application rates of NH_4NO_3 fertilizer.

Besides, with alum added to poultry manure, the losses via volatilization were also reduced significantly. Gao and Chang in 1996 also found out that after 18 annual applications of manure, the sand content in the 0 to 15-cm depth of soil in non-irrigated plots and in the 0 to 15 and 15 to 30-cm depths of soil in irrigated plots had decreased significantly. In addition, for further information, the changes in soil CEC, total organic carbon content and total nitrogen content in 0 to 15 and 15 to 30-cm soil depth were reported to increase with the increasing rates of poultry manure. Soil fertility was also improved in an amended soil with poultry manure in term of increased in the available N, P for crop season (Al-Kasi and Licht, 2004). The N and P content in crop residues in field plots receiving poultry manure were found to be higher than non-fertilized or chemical fertilized soils. Nitrogen (N) released through mineralization from broiler litter can supply the N requirements of crops, but litter might cause yield reductions and increased NO_3-N leaches losses, if applied in excess of crop needs (Flynn *et al.*, 1993). Poultry manure was also found to be more effective than chemical fertilizer (other ammonium fertilizer) in terms of reducing P in runoff and NH_3 volatilization (Moore and Edwards, 2005). The results of a long term research survey (20 years) proved that poultry manure and alum treated poultry litter would have consistently higher crop yields, lower P-soil losses with runoff water and higher soil pH than unfertilized or chemically fertilized field sub plots in the experimental Area. With the increase in pH value of soil, poultry litter treatments prevented the acidification of soil in a long-term research survey in comparison to using NH_4-NO_3 as a fertilizer.

In summary, land applied with poultry manure has shown to improve soil fertility and reduced soil acidity and toxicity (Al) in soil profile. However, in most of the studies, it was shown that the effects of poultry manure changed with initial soil conditions, soil types, cropping systems and climatic regimes as reported (Preusch *et al*., 2002). A systemic approach of integrated farm practice was required to improve soil condition by using a combination of cropping and tillage systems, N application rates, timing and application methods. Therefore, long-term studies are needed to critically evaluate the effects of poultry manure on soil water, soil erosion, soil quality and crop yields, either positive or negative impact to be ascertained.

Management/Handling of Poultry Manure to Conserve Nutrients.

According to Muller-Samann and Kotschi (1997), Poultry dropping was better placed on manure heap daily or every two days. It is better to build the heap up in sections and to stack up a small section quickly than to spread manure over the whole farmyard or farm land. They further explained that, small scale farmers are advised to build a heap 1.5 – 2.0m high with a wooden board or low wall surrounding it for protection. The section is then covered with a layer of earth (15–20 m) to reduce drying and loss of ammonia.

If it contains a high proportion of litter, the manure should be trampled down firmly. This step can be omitted only for densely compacted manure that is poor in litter. Heaps should be firmly reinforced round the edges to give them the necessary stability and to limit the exchange of gases. The manure heap is thus filled and stamped down section by section. It is a good idea to organize the heap in such away, as to allow access to older sections before new ones are used, so that decomposed manure is always made available. Haga, (1998) reported that, the objectives in composting are to stabilize the biodegradable organic matter in the form of raw wastes, to reduce offensive odours, to kill weed seeds and pathogenic organisms and finally, to produce a uniform organic fertilizer suitable for land application for maximum crop production.

Quantity of Poultry Manure Application

Typically, the input of nutrients from poultry manure are sustainable which has a great impact on crop yield, crop quality and environmental quality such as groundwater and surface and subsurface water quality for crop utilization. Muller-Samann and Kotschi (1997) reported that, there is some controversy as to how often and in what quantities farmyard manure should be applied to the soil. Although poultry manure is one of the best organic fertilizers available, and is an extremely valuable resource, excessive land application rates can lead to nitrate and phosphorus leaching into groundwater, phosphorus (P) runoff losses into adjacent water bodies, and possibly cause elevated bacterial or pathogen levels of infection in nearby lakes and rivers there by causing toxic substance in the ecosystem (Moore *et al*., 1995; Kanwar *et al*., 2005). Manure applied to field sub plots also risked the subsurface water and groundwater quality, if handled improperly (Kanwar *et al*., 1988; de Vos *et al*., 2000). Therefore, the main concerns with land application of manure rely on whether it is safe and biodegradable of its materials for the environment to avoid air and soil pollution and maintained good crop yield and crop quality (Power *et al*., 2001). Studies also proved that the application rates of poultry manure and types of poultry manure (broiler or litter) played an important role on the impacts of poultry manure on soil properties (Gilley *et al*., 2000).

Covering a large area of land with a small amount of Poultry manure requires more effort than covering a small area of land with a large amount of Poultry manure, Muller-Samson and Kotschi, (1997) further explained that the amount of Poultry manure applied should be determined by the effect sought. If the main aim is to replace deficient nutrients, enough should be applied to achieve a rough nutrient balance. An experimental result showed that even small amount of Poultry manure (2.5t/ha) has often been sufficient to make considerable impact on yield production of maize. This happens when a specific nutrient alleviated or when an important physical, chemical or biological property of the soil is changed (Muller-Samson and Kotschi, 1997). In addition, when larger N amount of Poultry manure is applied, it should be accompanied by certain measures to protect the soil from deterioration (Agboola *et al.,* 1975). The utilization of different rates of Poultry manure applied depends largely on the soil itself; an active well aerated soil for instance utilizes large stable Poultry manure with more ease than a poor aerated soil (Muller-Samson and Kotschi, 1997). Application of more of Poultry manure at the wrong time or improper handling of the substance may lead to the release of nutrients into the air and into the ground or surface water. This makes nutrients becomes pollutant instead of nourishing crops (Fulhage, 2000). Poultry manure contamination can increase nitrate levels in ground water and caused bacterial contamination and the death of fish in surface waters. Excess phosphorus can be contained in erosion or runoff of water from fields and accumulate in surface water impoundments, such as ponds and lakes. This phosphorus can stimulate unwanted plant growth, such as algae, which causes turbidity and other undesirable conditions in water. Fulhage, (2000) further stated that, a common misused of Poultry manure is to spread it on a field and then, in addition, apply commercial fertilizer to supply a crop's nutrient needs with no consideration for the manure's nutrient value. An efficient manure management and application system meets, but does not exceed, nutrient needs of the crop, thereby minimizing pollution in both soil and air.

Method and Time of Poultry Manure Application

After proper collection of good Poultry manure, transport and storage of good nutrient rich manure and also having the knowledge of application rate, it is sacrosanct to apply the manure on the field in an effective manner. Spreading should be done evenly without disturbing the root area of the crop planted. This is easier to achieve with decomposed manure and manure composts than with fresh manure containing crop straw. After spreading, manure should be worked into the soil as soon as possible, since long exposure on the surface causes loss of nutrients and fertilizing effect (Muller-Samann and Kotschi, 1997). Collins and Younos (1996) stated that solid manure can be incorporated by tillage immediately following its application, and liquid manure slurry can be injected into the soil. Manure application should be applied close to time of planting to maximize N uptake by crops and minimize the loss of N through run-off or leaching down the soil profile. Incorporating the manure close to the surface is better than deep incorporation. The lighter the soil, the deeper the manure should be incorporated (>20cm). Highly decomposed or fermented manure can be ploughed in deeper than relatively fresh manure. The manure should be well mixed with the soil and no dense clumps should be left in the subsoil. A special form of manure application is as surface compost mulch. In heavy soils, surface application of this kind can contribute to physical improvement of the site by stimulating soil life (Jaiswal *et al*., 1971). However, the loss of nutrients with this method is high, and the nutrient effect becomes secondary to the mulching effect. Surface compost mulch is only recommended on good soils well supplied with nutrients or farms with large supplies of manure, and where the aim is to achieve soil physical improvements, for example in combination with sowing green manure in to the soil to increase soil fertility.

Effect of Manure on Nutrients and Crop Yield

The fertilizing effect of Poultry manure especially, to determine, nitrogen effect, on farmyard manure usually lags behind that of corresponding amounts of soluble mineral fertilizers at the first stage, because in the first growing period only about 30 –60 % of the farmyard manure N becomes available. Soil nutrients was fixed at the beginning of application and later, to build up the soils humus and nutrient supplied. The nutrient supplied to the crops later starts to increase significantly with regular applications of farmyard manure to enhance crop development (Prasad and Singh, 1980). After two or three applications, both the immediate effect and the delayed effects of earlier applications coincide, and the manure starts to have its maximum impact on crop yields (Jones, 1971). Murwira *et al*. (2002) in an experiment to determine the fertilizer equivalence (F.E.), values of organic materials of differing quality reported that from seven cluster sites in Zimbabwe, there was a positive effect of using N-poor manures at Chinonda, Manjoro, Chiteme and Mukudu. At three of the four sites, the manure effects were pronounced positively. Addition of 5000 kg manure increased yield by 1000 kg ha^{-1} of grain yield compared with the control except at Chisunga site. The incremental levels of inorganic nitrogen applied also resulted in an increased in yield levels that was achieved. At

Chinonda, supplementation of 5000 kg ha^{-1}manure with at least 40 kg N ha^{-1} of inorganic fertilizers resulted in a statistically significant yield increase was only obtained after applying 100 kg N ha^{-1} of inorganic N fertilizer. The percentage fertilizer equivalency of manure at Chinonda, Majoro, Chiteme, Makudu and Mapira sites were calculated to be 30%, 30%, 10%, 20% and 35% respectively.

Murwira *et al*., (2002) concluded that, the manures had nitrogen F.E. values of less than 30 %. The initial N content of the manures could not explained the observed trend of N fertilizer equivalencies. From the manure studies, it can also be concluded that not all manure with C:N

values less than result in net N mineralization when added to the soil. The results suggested that other indices of manure quality have to be investigated to improve the prediction of the effects of manure application on N availability and crop yields. A lot of the manure samples were not pure droppings of poultry, but rather a mixture of droppings of livestock and maize residues and therefore they might not be a simple index for predicting N mineralization patterns and fertilizer equivalency values.

Quite noticeable in tropical sites of soils that have the effects of manure as a P fertilizer and the improved effectiveness of mineral P fertilizers when combined with manure in order to enhance crop production (Mokwunye 1980). In (1975), Agboola *et a.,l* described a typical case of this on an extremely acidic, humid tropical site, where they found that mineral P fertilizer had no effect on cowpea. But, when the fertilizer was applied with relatively small amounts of farmyard manure (2.5 t.ha^{-1}), increasing the amount of P applied also increased yields of crop .A deficit of P or a decrease in its availability on cultivated soils can be counteracted by fertilizing with farmyard manure (Godefroy, 1979; Prasad and Singh, 1980). The reasons why manure brings about an increased in available P are both chemical and physical in nature, due to higher pH, lower C/P ratio and biological (heightened biological activity, increased mineralization of P compounds, increased root activity etc).

Ofori in 1980 suggested the following additional reasons for P availability, due to manure application in the soil: organic colloids, prevent dissolved phosphate from coming into contact with free aluminium and iron; when organic matter decays, the carbonic acid then forms dissolved phosphate; organic phosphorus is less strongly fixed by the soil and microorganisms mineralized organic phosphate compounds.

The impact of farmyard manure on yields depends strongly on the site of the natural soils, that is, on the primary effect on soils (as N or P fertilizer, biological, physical) and on the state of the soil. On a dry savannah site in the Sudan, yields of sorghum were increased from 1.3 t ha^{-1} to 2.4 t ha^{-1} (i.e. by over 80%) by using just 4.0 t manure ha^{-1} (Musa, 1975). In contrast t ha^{-1} had little effect on a site in highland of Rwanda. The maize yield increased by only30% to 1.3 t ha^{-1}. On a neighbouring degraded site in the same country, maize yield was increased from 0.6 to1.3 t ha^{-1}. The effect here, with a rise of 116%, was very definite. Altogether, the results from Rwanda show that farmyard manure can positively affect yields in the second and sometimes even in the third subsequent cropping season (Piettrowicz and Neumann, 1987).

Materials and Methods

Experimental Site Location

Field experiment was conducted at the University Teaching and Research Farm, Niger Delta University, Wilberforce Island, Bayelsa State (Latitude 5^0N and Longitude 6.05^0E) during the 2016 cropping season to determine the "Effect of Different Rates of Poultry Dropping on the Growth and Yield of *Zea mays*". The experiment ran through May - August 2016.

Land Use for the Experiment

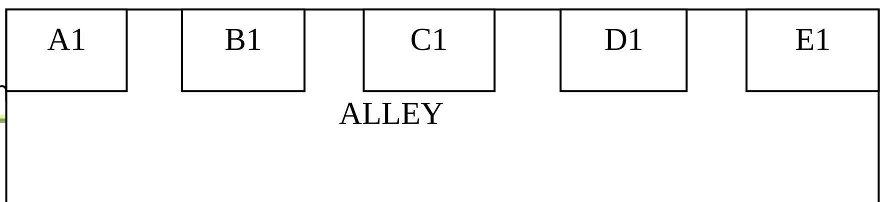
The land used for the experimental operation was located North-East of the University Teaching and Research Farm. The land, having a typical humid environmental condition was dominated with root tubers mainly cassava, yam and cocoyam root tubers which indicated that the land was previously used for various Agricultural operations. The soil was well drained having vegetation mostly covered with weeds, herbaceous plants, tall grasses which were interrupted by few trees. The topography of the land was characterized with gentle slopes making some areas water logged during heavy rain fall.

Experimental Design

The experimental design used was Randomized Complete Block Design (RCBD) which had four treatments of poultry droppings represented as (20t/ha, 15t/ha, 10t/ha and 5t/ha) including a control which is represented as 0t/ha, which makes a total of five treatments. Each treatment was replicated five times to give a total of 25 experimental sub plots.

Land Preparation and Plot Layout

A land of size 27.0m by 12.5m was obtained and mapped out using measuring tape, twines and pegs to secure land from unauthorized personnel and was manually cleared using cutlasses on the 23rd to 28th of April 2016. Raking and mapping out of 25 experimental sub plots in each of the sub plot was size of 5m by 2.1m and creating walkways of sizes 0.5m between and within rows and columns was carried out on the 9th to 10th of May 2016. Tiling practise of each sub plots with the use of hoes and pining of tags labelled with treatments and replicates was done on the 10th to 12th of May 2016.



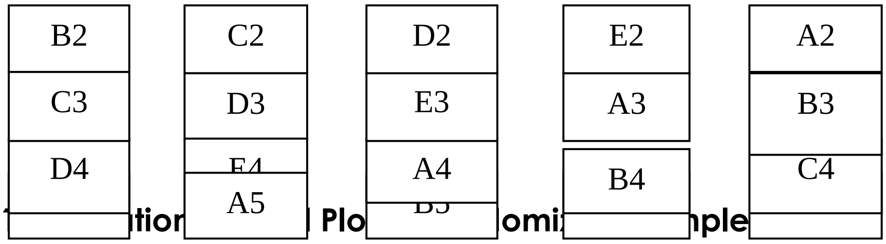


Fig ... tion ... Plo ... omi ... nple ... Design

Treatments Application

Treatments used for the experiment was poultry droppings measured (weighed) according to the stipulated rates and separated into 25 different bags according to the subplots used for the experiment. The different rates are indicated as follows; E=0t/ha used as control, A=5t/ha, B=10t/ha, C=15t/ha and D=20t/ha. Total amount of poultry dropping needed for experiment equals to 50t/ha, which in turn equals to 262.5kg of poultry dropping.

Method of Treatment Application

Treatment application was carried out on the 13th of May, two days before planting. Slurry was made with the lowest treatment mixed with 10 litres of water and as the rate of treatment increases by 5, amount of water used increases by 10 litres. Slurry was applied with watering can to each experimental plot according to the treatments in order to aid even distribution of poultry dropping slurry within each plot.

Planting Materials

Pro Vitamin A maize seeds (Dent corn also known as field corn) were bought from the International Institute of Tropical Agriculture (IITA) located in Ibadan, Oyo State, Nigeria.

Planting

Planting was carried out on the 15th of May 2016 from 5pm. The seeds were sown at a rate of two seeds per stand and with a spacing of 0.7m by 0.3m at a planting depth of about 5-7cm which was later thinned down to one plant per stand to reduce competition for sunlight and nutrients and also to avoid overcrowding in other to improve their growth performance. Experimental farm plot had a total of 47,619 plants/ha as the plant population.

Field Maintenance

Seed sprouting/emergence began on the 18th through the 22th of May and to this effect, supplying of missing stands was also carried out on the 1st of June, two weeks and three days after planting. Earth up/Hilling of individual stands was done to prevent exposure of roots and to enable plants stand firm to avoid lodging and damage of plants due to heavy rainfall accompanied by wind. Base weeding was carried out several times to avoid weed infestation throughout the growth period.

Data Collection

Maize data collection was done on the date of planting, date of emergence date of flowering and on the following parameters:

1. **Vegetative Parameters** which includes; Plant height (cm), Number

of Nodes, Internodes and Leaf area (cm). Data collection was taken from ten random plants (sample population) from each experimental plot.

2. **Cob Parameters** which includes; Cob length (cm), Cob girth (cm), Number of rows per cob and Number of kernels per cob. Data was collected from two cobs gotten from each experimental plot to make a total of 10 cobs from each treatment.

3. **Yield Parameter** which includes; Weight of 1000 kernels of each treatment/plot and weight of total yield per plot (t/ha).

Plant height was measured using a 5m measuring tape from the base to the highest of the flag leaf. Number of nodes and internodes were determined by manually counting them, leaf area was calculated using the formula (L x B x Coefficient) where L and B where measure using a measuring tape and coefficient is a standard value of 0.75cm.

Cob length and girth was obtained using a rope and a 30cm rule, while number of rows per cob and number of kernels per cob was determined by counting. Weight of 1000 kernels was obtained by using electronic weighing scale, while total yield per plot was obtained using a 10kg weighing scale.

Statistical Analysis

All data collected on the three main parameters were subjected to Analysis of variance (ANOVA) and statistical calculations were done to determine the Least Significant Different (LSD) using 5% significant level between the mean of each treatments used, and all results were represented in tables, appendix and charts in other to draw a healthy conclusion and administer reliable recommendations.

RESULTS AND DISCUSSION

Effect of poultry dropping on Plant height and Leaf area.

In figure 1, bar chart showing mean heights of plants and mean leaf areas of each treatment is presented. These are important characteristics that influence the quality of plants in relation to yield. Leaf Area had steady increase of leaf from the treatment applied from 10t/ha^{-1} to 20 t/ha^{-1} respectively when compared to 0t/ha^{-1}. Fig 1 shows that mean height of plants ranges from 153.79cm to 196.06cm from the application of poultry manure when compared to the control (0t/ha^{-1}) that had 159.02cm. Comparing treatments on the basis of this characteristics in relation to the least significant difference (LSD), our record shows that treatment D (20t/ha^{-1}) mean value of plant height is significantly higher than treatment B (10t/ha^{-1}), A (5t/ha^{-1}) and E (0t/ha^{-1}), while treatment C (15t/ha^{-1}) also differs s significantly from A (5t/ha^{-1}) and E (0t/ha^{-1}) on the mean values of this characteristics.

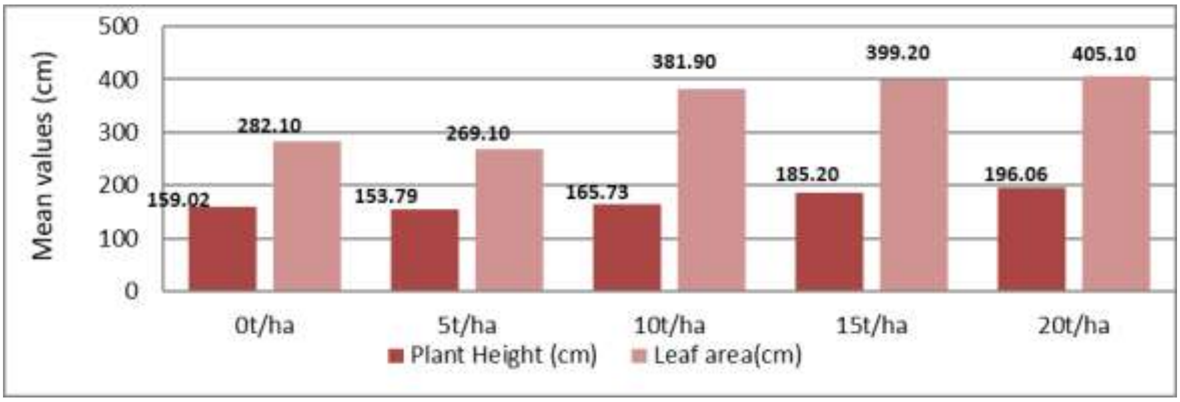


Fig 1: Bar chart showing difference in plant height and leaf area of treatments on effect of Poultry dropping (Manure) application rates on Maize production. LSD Values; Plant Height =22.36 and Leaf Area= 64.70.

Effect of poultry droppings on the cob length and girth of maize cob

Presented in figure 2, is a bar chart showing variations in length and girth of maize cobs. Comparing each treatment mean to the LSD, to know the difference in sizes of the cobs in girth and length, between each treatment, results showed that for cob length, treatment D (20t/ha^{-1}) differs significantly, from treatment A (5t/ha^{-1}), B (10t/ha^{-1}), and E (0t/ha^{-1}), but does not differ significantly from treatment C (15t/ha^{-1}). While treatment C (20t/ha^{-1}) differs from A (5t/ha^{-1}) and E (0t/ha^{-1}). Treatment B (10t/ha^{-1}) is higher than A (5t/ha^{-1}) and E (0t/ha^{-1}), but does not have significant difference from leaf area A (5t/ha^{-1}) and E (0t/ha^{-1}). In addition, for cob girth, although treatment C (15t/ha^{-1}) is higher in value than treatment D (20t/ha^{-1}), there is no significant difference between each treatment, as it ranges from 9.28 to 10.81.

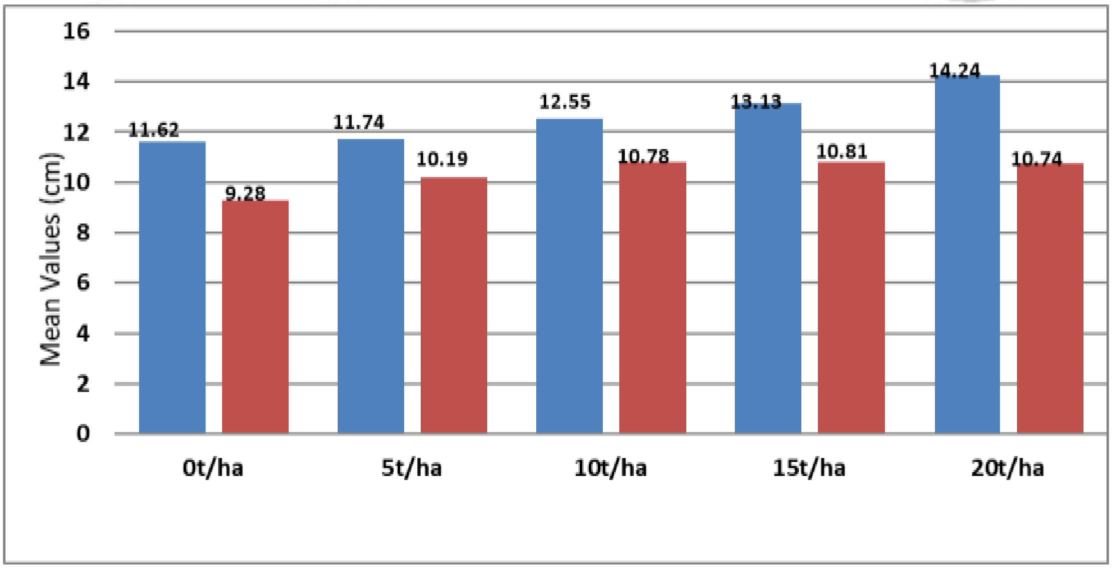


Fig 2: Bar chart showing variations in length and girth of cobs on effect of Poultry dropping (Manure) application rates on Cob Length and girth of Maize cobs on Maize production. LSD Values; Cob Length =1.33 and Girth of Cob= 0.44.

Average Number of Kernels per Cob

Figure 3, bar chart showing the average number of kernels gotten from two cobs taken from each treatment plot.

Comparing the average number of kernels per cob in each treatment means to LSD, it shows that treatment D ($20t/ha^{-1}$) has a very high significant difference compared to treatment B ($10t/ha^{-1}$), A ($5t/ha^{-1}$) and E ($0t/ha^{-1}$), but does not differ significantly from treatment C ($15t/ha^{-1}$). Treatment C ($15t/ha^{-1}$) on the other hand is higher than B ($10t/ha^{-1}$), A ($5t/ha^{-1}$) and E ($0t/ha^{-1}$), and differs significantly from them, but not different from D ($20t/ha^{-1}$). Treatment B ($10t/ha^{-1}$) differs significantly from E, but does not differ significantly from A ($5t/ha^{-1}$), while treatment A ($5t/ha^{-1}$) and E ($0t/ha^{-1}$) are not significantly different from the other treatments, but A ($5t/ha^{-1}$) is higher than E ($0t/ha^{-1}$). From the results, it is obvious that treatments D ($20t/ha^{-1}$) and C ($15t/ha^{-1}$) are highly significant and differs greatly from the other treatments.

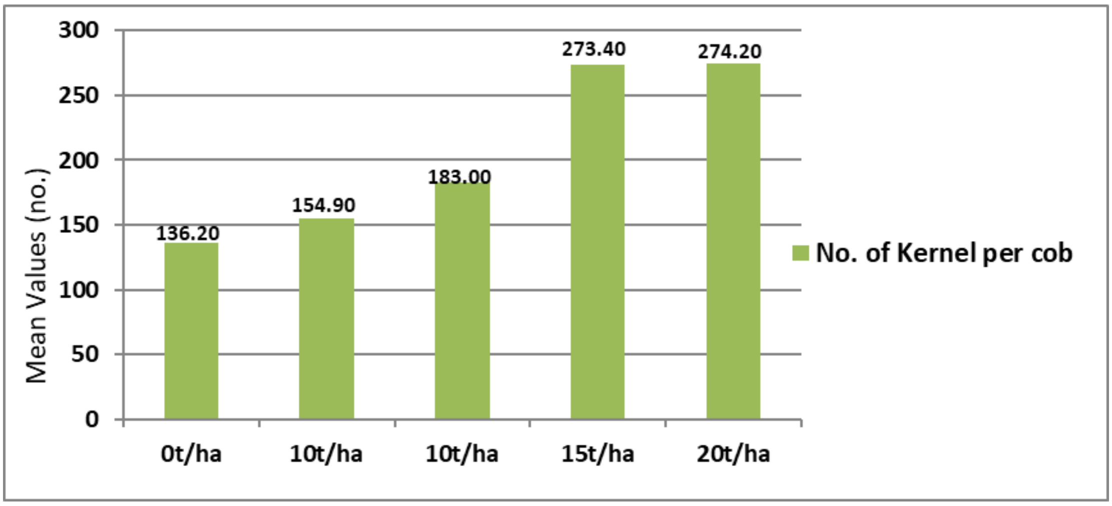


Fig 3: Bar chart showing difference in number of average kernel per cob on effect of Poultry dropping (Manure) application rates in number of kernel per cob on Maize production. LSD Value; Average Kernel per cob = 1.66.

Weight of 1000 Kernels

Figure 4 shows the weight of 1000 kernels measured in grams of each experimental plot. Comparing each treatment mean to the LSD, results shows that treatment D ($20t/ha^{-1}$) has very high significant difference compared to A ($5t/ha^{-1}$), B ($10t/ha^{-1}$) and E ($0t/ha^{-1}$), but not significantly different from C ($15t/ha^{-1}$), though it is higher. Treatment C ($15t/ha^{-1}$) differs significantly from A ($5t/ha^{-1}$) and E ($0t/ha^{-1}$), though it is higher than B($10t/ha^{-1}$), it does not differ significantly from B ($10t/ha^{-1}$), while treatment B ($10t/ha^{-1}$) differs significantly from E, but does not differ significantly from A ($5t/ha^{-1}$). Treatment A ($5t/ha^{-1}$) is higher than Treatment E ($0t/ha^{-1}$), but it's not significantly different from treatment E ($0t/ha^{-1}$).

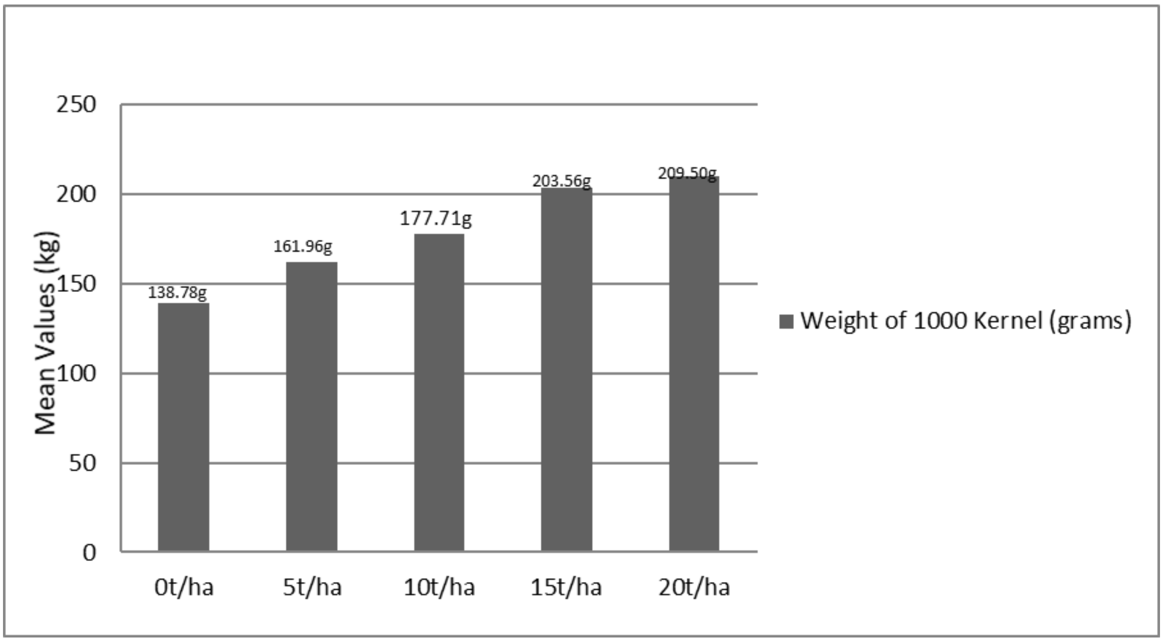


Fig 4: Bar chart showing the weight of 1000 kernels from each treatment on effect of Poultry dropping (Manure) application rates on weight of 1000 kernels on Maize production. LSD Value; Weight of 1000Kernels = 28.42.

Total Yield

Presented in Figure 5 is the yield in ton/hectare of each experimental plot.

Comparing each treatment mean to the LSD, to know the rate at which each treatment differs from each other, results showed that treatment D (20t/ha^{-1}) and C (15t/ha^{-1}) are equal and differs significantly from treatment E (0t/ha^{-1}), but does not differ significantly from treatment B (10t/ha^{-1}) and A (5t/ha^{-1}). Treatment B(10t/ha^{-1}) on the other hand is not significantly different from A(5t/ha^{-1}) and E (0t/ha^{-1}), though its larger than A (5t/ha^{-1}) and E (0t/ha^{-1}). Both A (5t/ha^{-1}) and E (0t/ha^{-1}) are also not significantly different from the other treatments.

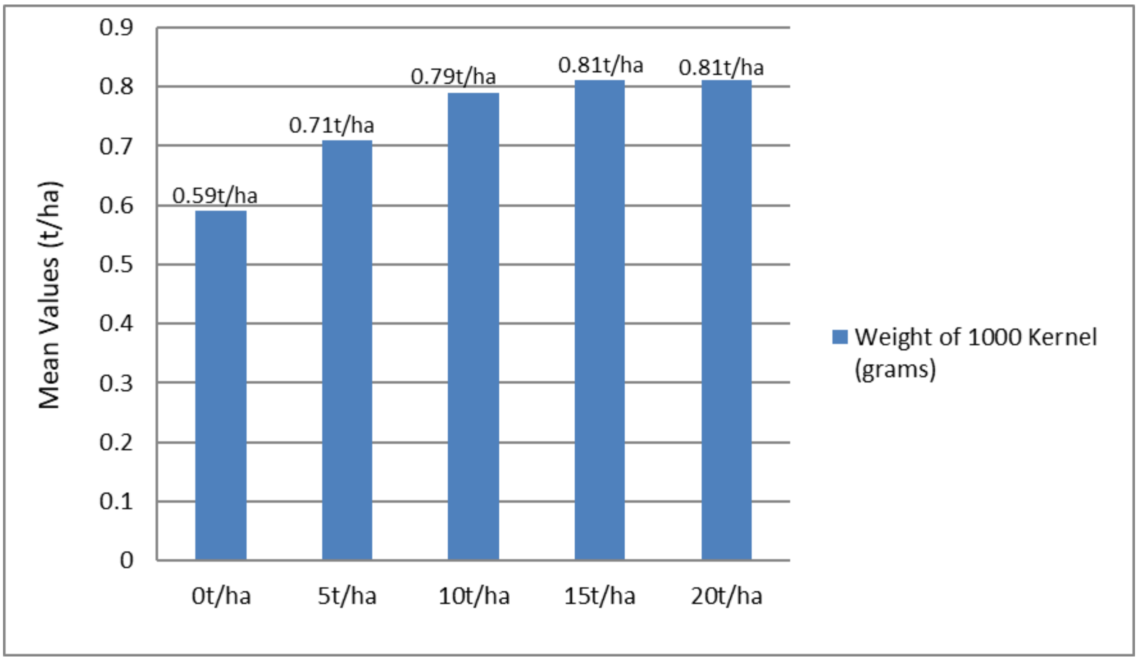


Fig 5: Bar chart showing the difference in yield of each treatment on effect of Poultry dropping (Manure) application rates on the yield of Maize production. LSD Value; Total Yield = 0.21.

DISCUSSION

Poultry manure has long been recognized the most desirable organic fertilizer in the Global World. It improves soil fertility by adding both macro and micro essential nutrients as well as soil organic matter, which improved moisture and nutrient retention in the soil for crop development. However, this research investigates the effectiveness of different levels of applied poultry manure (PM) on the growth and yield of spring maize (*Zea mays* L). However, the present research findings shown that application of poultry manure at 10t/ha^{-1} to 20t/ha^{-1} significantly influenced all the vegetative parameters (length of cob, girth of cob, weight of 1000 kernels (yield), and plant height, leaf area)for maximum maize yield production, which were evaluated when compared to the 0t/ha^{-1}, however these findings were in conformity with some previous researcher's findings as indicated below, though their research work had combination of treatment effect with inorganic fertilizers and plant materials has illustrated with some research findings.

Farhad *et al*., 2007. Conducted an Agronomic Research, at the University of Agriculture, Faisalabad during spring season 2007 and published at 2009. The experiment consisted of six treatments: control, 4 t per ha PM, 6 t per ha PM, 8 t per ha PM, 10 t per ha PM and 12 t per ha PM. Experiment was laid out in randomized complete block design with three replications. Number of cobs per plant was not significantly affected by the application of different levels of Poultry Manure (PM). While all others recorded parameters included plant height, number of rows per cob, number of grains per row, 1000-grain weight, grain yield, biological yield and harvest index were significantly affected by application of PM. Maximum values for all these parameters were recorded with the application of 12 t per ha PM these findings are in agreement with the current research findings that were evaluated at the Niger Delta University Teaching and Research Farm, Bayelsa State, Nigeria by Alamene *et al*., 2016, poultry manure applied at the rate of 10t/ha^{-1} to 20t/ha^{-1} application significantly influenced the growth parameters of maize alongside with the yield. Furthermore, the current research findings are still in conformity with some other researchers in their previous works.

Plant height was significantly affected by different levels of poultry manure (PM). The comparison of treatments' means value revealed that maximum plant height (230 cm) was recorded from plots treated with 12 t ha-1 PM was applied (T6) followed by T5 (10 t ha-1) which was statistically at par with T6. Application of 4, 6 and 8 t ha-1 PM did not differ significantly from each other, with respect to plant height of maize while control (no PM) gave minimum plant height. The increase in plant height with PM was mainly due to the reason of more availability of nutrients by PM throughout the growing season. These results are in accordance with the findings of Mitchell and Tu (2005) and Warren *et al*. (2006). The results further indicated that number of cobs per plant was not significantly affected by the application PM. This might be attributed to the reason that cob bearing potential of a variety controlled by its genetic makeup rather than the agronomic practices. Non-significant effects of NP application on number of cobs per plant have also been reported by Maqsood *et al*., (2001). Number of grain rows per cob is an important yield determining factor in maize production. It affects the number of grains per cob and cob weight. This also significantly revealed that different levels of PM had significant effect on number of grain rows per cob. Significantly maximum number of rows per cob (16.0) was recorded in treatment T6 applied plots at 12 t ha-1 PM was applied, and was followed by The Journal of Animal & Plant Sciences 19(3): 2009, Pages:122-125 ISSN: 1018-7081 124 T5 and T4 each of which produced 12 rows per cob. The lowest number of rows per cob (8.0) was recorded in case of T1 (control plot) where no PM was applied. It was statistically at par with T2 and T3 treatments. The increase in number of grain rows per cob in case of 12 t ha-1 PM was mainly, due to the reason of more availability of nutrients from PM throughout the growing season. These results are similar to the findings of Zhang *et al*. (1998) who reported that precise application of manure and mineral fertilizer to maize crop could be as effective as commercial N fertilizer for yield response. Number of grains per row is also an important parameter contributing towards the final yield, that number of grains per row was significantly affected by different levels of PM. The comparison of treatments' means revealed that maximum number of grains per row (29.1) was recorded from plot fertilized with 12 t ha-1 PM (T6) which was statistically equal to that of T5 (10 t ha-1 PM) and T4 (8 t ha-1 PM) followed by T3 (6 t ha-1 PM) which was in lined with that of T2 (4 t ha-1 PM). The minimum number of grains per row (18.1) was recorded from plot where no manure was applied (T1). This increased the number of grains per row might be attributed to the availability of more nitrogen and other nutrients from PM required for plant development up to cob formation. One Thousand grams (1000-grains) weight was affected significantly by different levels of poultry manure application. Maximum 1000- grain weight (254 g) was recorded from plots where PM was applied @ 12 t ha-1 (T6) followed by T5 (241g). The minimum 1000- grain weight (173 g) was noted in control (T1) which was however, statistically in lined with that of T2 treatment (179 g). These results are in accordance with the findings of Ma *et al*. (1999) and Garg and Bahla, (2008) also with Alamene *et al.,* 2016. The increase in 1000- grain weight with increased level of PM could be due to balanced supply of food nutrients from poultry manure throughout the development of the plant. Biological yield was significantly affected by different levels of poultry manure, that maximum biological yield (22.2 t ha-1) was obtained in T6 applied at 12 t ha-1 PM was applied which was statistically equal to that of T5 (10 t ha-1 PM) and T4 (8 t ha-1 PM) treatments giving biological yields of 21.2 t ha-1 and 20.3 t ha-1, respectively. The lowest biological yield in T1 (13.4 t ha-1) was recorded from plot without PM application (control) which was statistically in lined with that of T2 treatment. These results are in line with those of Deksissa *et al*. (2008). Grain yield is a function of interaction among various yield components that were affected differentially by the growing conditions and crop management practices. It is a clear fact that grain yield was significantly affected by the application of different levels of PM. All the mean values clearly shown that significantly highest grain yield (5.11 t ha-1) was recorded from T6 applied rate at 12 t ha-1 poultry manure was applied, followed by T5 (10 t ha-1 PM) which was statistically equal to that T4 (8 t ha-1 PM), the grain yield produced by these plots were 4.16 t ha-1 and 3.60 t ha-1 , respectively. Similarly, statistically, same grain yield was recorded in case of plots of T2 (6 t ha-1 poultry manure) and T1 (control) treatment. These results are in accordance with the findings of Boateng *et al*. (2006) and Alamene *et al.,* 2016 that poultry manure significantly increased the grain yield of maize. The physiological efficiency of maize to partition the dry matter into its economic (grain) yield is referred by harvest index. Higher the harvest index, greater was the grain yield. Application of different levels of poultry manure had significant effect on harvest index as shown in the above illustration. The comparison of treatments' means shows that the maximum harvest index (23.1%) was recorded from maize crop manured @ 12 t ha-1 PM which was in lined with T5 (10 t ha-1 PM). The lowest harvest index (13.60%) was recorded in plot were no manure was applied (control), it was however statistically in lined with that of T2, T3 and T4 treatments.

Leaf area index (LAI) and height were evaluated, according to Shortall & Liebhardt (1975), LAI and grain yield are positively correlated as long as the LAI is below 5, hence, the need to measure LAI. About 75% of the maximal leaf area was produced before the 6th week for 6, 8 t pm/ha and 2 t pm/ha + ½ NPK rates. The highest LAI was 2.1 reached by 6 t pm/ha at the 10th week followed closely by the 8 and 4 t/ha^{-1} rates, while the lowest LAI of 0.6 was registered by the control. These observations, though values were low, indicate that the LAI was significantly influenced by the application of poultry manure and mineral fertilizer. It appeared that the 6 t/ha^{-1} rate was emerging as a better choice than 8 t/ha^{-1} probably due to a phenomenon of decreasing returns

The height of maize plant also followed a similar trend with the tallest plants from the 6 t pm/ha rate and shortest from the control. Values from 2 × 2 t pm/ha and 2 t pm/ha and 2 t pm/ha + ½ NPK compared very well with that of the 6 and 8 t pm/ha rates. Obi & Ebo (1995) noted significant improved average maize height upon application of poultry manure to a severely degraded ultisol in southern Nigeria, however the current research findings are in agreement with the previous research, expect the combination treatment effect that was reported in the previous experiment

The results also indicated that poultry manure at a rate of 4 t/ha has the potential to improve maize yields significantly over control. Poultry manure application rates might serve as an alternative to chemical fertilizer at the rate used in this study and may be recommended. This is because the increase in rate of application of the manure beyond 4 t/ha did not result in significantly proportional increase in biomass yield, i.e. dry matter gains decreased at an increasing rate of manure application above 4 t/ha. It may also not be very practicable for peasant farmers to use as high poultry manure rate as 8 t/ha. It may be noted that manure application of 4 t/ha is relatively easier than application of 2 t + ½ NPK/ha.

The lowest poultry manure rate plus one-half rate of chemical fertilizer (i.e. 2 t/ha + ½ NPK) yielded significantly higher than the full dose of NPK alone. This implies that integrated approach of application of organic and inorganic fertilizers might be more desirable than either type of fertilizers alone to be applied. In such cases, synergism might be at work. This is in agreement with the finding of Vasanthi & Kumaraswamy (2000) who reported that poultry manure plus one-half rate of the chemical fertilizer rate yielded significantly greater amount of green fodder of corn than the full rate of NPK alone, because of the presence of Nitrogen content.

Grain yields (although much lower than the real yield potential of 4.6 t ha-1 (GGDP, 1991)) also followed the same trend as that of the biomass. All the treatments had significant improvement over control signifying the importance of fertilizing or manuring the soil for maximum maize production to boost the soil nutrients.

The lowest rate of manure application (2 t/ha^{-1}) improved yield by 136% over the control. Grain yield increased with increasing rate of manure application. However, yield increases were not significantly different among treatments except the control and 2 t/ha which were significantly lower. There is also the possibility of combining low rate of poultry manure (i.e. 2 t) with a low NPK rate (30-20-20 kg). In this way, chemical fertilizer application is reduced (Bandel *et al*., 1972; Baldwin, 1975; Hileman, 1967), thereby, precluding excessive salt concentrations in the soil solution (Yagodin, 1984) and most probably reducing costs. Conclusion The study indicates that poultry manure is a valuable fertilizer whose use needs to be encouraged. An application rate of 2 t/ha was capable of increasing yields by more than 100% over the control, because of the presence of microbes to facilitate the release of soil nutrients to the roots of maize plant for rapid absorption.

Application of poultry had an influence in plant height. Mitchell & Tu (2000) and Dauda *et al*. (2008) found enhancement of plant height through application of poultry manure. This increase in plant height could be associated with continuous supply of nutrients by poultry manure (Farhad *et al*., 2009). Furthermore, enhancement of shoot apical meristem might be the reason behind achievement of better height. It seemed that application of 5 t/ha of poultry manure enhanced the activities of apical meristem, because there was significant interaction between the soil and the roots of the plant for the two factors at $p \leq 0.05$. This implied that none of the main factors singly influenced stem girth. However, plant density was significant (p≤ 0.05) at 6,10 and 12 weeks after planting, without interacting with other factors. It could be said that plant density also influenced the plant girth whenever its effect was significant. This is because higher plant density led to higher intra-specific competition and vice versa. This phenomenon has direct effect on the plant size. Finally, the best treatment combination in this study was T6 (5.0 t/ha poultry manure + 53,333 plants/ha + Suwan-1-SR

Poultry manure has high amount of nitrogen when applied to the soil (Dauda *et al*., 2008). So, the more the poultry manure applied the higher the nitrogen available to the plants which aids luxuriant vegetative growth of plants, which, if not checked results in delay in attainment of reproductive stage (Akongwubel *et al*., 2012). As it was observed in this experiment, the shortest number of days to silk and tassel production of maize was through the control application of manure. Therefore, higher plant density enhanced earlier attainment of reproductive stage of maize because the plants were deprived of the opportunity of getting more than enough nitrogen, that would have led to unnecessary luxuriant growth, that could have resulted, if the plant density was less.

Effects of poultry manure, variety and population density on dry weight of maize plant parts All forms of dry weight measured were significantly influenced by the combination of poultry manure, variety and population density at p≤ 0.05. Thus, the main factors could not singly influence dry matter production because of the interaction that existed among all the component factors used. T6 (5.0 t/ha poultry manure + 53,333 plants/ha + Suwan-1-SR) enhanced root, stem and total dry /

However, from the above illustrations, from the different researchers shows that the importance of poultry manure cannot be over emphasized for maximum maize and other crops production as an alternative to commercial chemical fertilizers, because they are environmental friendly and easily biodegradable for the safe ecosystem for crop production.

CONCLUSION/RECOMMENDATION

CONCLUSION

The results from the experimental research operation carried out shows that 20t/ha^{-1} and 15t/ha^{-1} of poultry dropping applied had treatments effect which gave a higher significant effect on plant heights when compared to 10t/ha^{-1}, and 5t/ha^{-1} poultry dropping, and the control plot (0t/ha^{-1}). The results of the study shown that 20t/ha^{-1} and 15t/ha^{-1} of poultry dropping gave a fairly high significant difference in the yield of *Zea mays,* compared to the other treatments (10t/ha^{-1}, and 5t/ha^{-1}) and 0t/ha (control).

The result from the weight of 1000 kernel of maize from each treatment shows that 20t/ha^{-1} and 15t/ha^{-1} of poultry dropping applied gave a very high significant result compared to the other treatments and control.

It was also observed that the 20t/ha^{-1} and 15t/ha^{-1} of poultry dropping applied gave a very high significant difference in the number of kernels per cob when compared to the other treatments and control.

The other parameters evaluated had similar trend of results as stated above (number of kernel row per cob length, cob girth and Leaf Area) and others such as number of nodes and internodes, are presented at the Appendixes were all subjected to ANOVA and their mean values were compared, using the LSD values. The results showed that 20t/ha^{-1} and 15t/ha^{-1} of poultry dropping applied has a higher significant difference and also had greater advantages when compared to the other treatments (10t/ha^{-1}, 5t/ha^{-1} and the control (0t/ha^{-1}). This current research findings, proved positive that poultry droppings are good source of sustainable environmental friendly bio-fertilizer that are easily bio degradable to enhance maize production whose findings are in agreement with most of the previous researcher's findings on poultry droppings

RECOMMENDATION

Experimental studies are carried out in order to discover new theories which helped in drawing healthy conclusions and giving profitable recommendation. From the experiment and the results shown in chapter 4 and the appendixes, we hereby recommend 20t/ha^{-1} and 15t/ha^{-1} of poultry dropping as the ideal treatment to be used when compared with 10t/ha$^{=1}$, 5t/ha^{-1} and 0t/ha^{-1}. This is because 20t/ha^{-1} and 15t/ha^{-1} gave the highest results in all the parameters taken for the experiment, therefore, 15t/ha^{-1} can be used instead to 20t/ha^{-1}, since they both gave high significant result, because they are cost effective that small scale farmers can easily afford for crop production. As also stated by some of the previous researchers, that application of lower dosages of poultry manure in combination with either plant materials or chemical fertilizer could be considered for the exercise for maximum maize production in the country, Nigeria.

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APPENDICES
Plant Height (cm)

Num/ Rep	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
	E1	E2	E3	E4	E5	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5
1	120.7	150.5	155.0	150.8	170.0	155.8	147.9	159.4	130.3	126.9	172.1	182.5	163.3	178.0	170.5	214.6	199.3	204.2	206.0	185.3	170.3	192.2	200.3	215.8	190.4
2	172.5	146.7	176.4	159.3	157.4	147.6	148.1	156.2	152.5	119.4	175.3	170.0	148.4	162.3	170.9	188.2	171.6	192.6	194.4	166.8	182.4	182.4	197.6	211.3	187.3
3	148.3	133.3	162.5	164.1	185.7	166.5	136.5	178.5	168.6	136.2	187.7	202.2	145.9	161.5	150.7	186.1	177.9	189.1	182.3	172.2	185.4	184,9	198.7	210.4	190.6
4	144.1	134.7	155.2	157.0	184.3	163.0	134.5	156.4	169.2	140.3	167.2	187.3	160.1	155.3	146.4	190.1	200.5	184.9	180.6	176.1	166.1	188.2	213.1	224.2	182.8
5	158.2	120.0	168.6	166.3	185.5	180.6	178.7	147.9	153.7	155.9	165.9	200.8	159.2	164,4	150.1	190.2	180.6	187.0	185.8	165.9	175.6	191.5	205.6	214.9	205.3
6	140.8	137.1	167.7	157.5	194.5	151.2	146.5	149.0	125.9	173.0	178.0	187.0	134.5	128.1	140.5	197.6	188.1	195.3	177.9	174.5	197.9	195.8	201.5	216,5	213.0
7	150.4	146.2	153.9	175.1	210.7	191,6	167.5	154.2	151,0	145.1	163.4	193.5	156.3	140.4	160.9	213.7	187.2	184.5	164.2	182.5	178.7	210,4	210.7	210.2	219.9
8	125.3	116.2	151.1	154.9	220.3	174.0	145.0	179.5	162.4	143.3	190.2	202.3	139.5	122.9	157.7	197.2	171.5	192.1	183.0	185.4	165.0	195.7	213.2	213,9	183.2
9	132.5	124.3	167.5	156.5	196.7	190.4	131,1	133.7	141.6	140.1	182.5	184.9	142.7	145.5	165.8	187.0	184.9	179.9	166.0	169.5	163.1	190.6	207.4	207.0	180.4
10	153.4	146.5	198.8	162.3	183.9	178.3	125.5	166.5	175.3	137.2	177.9	202.0	146.0	169.3	176.5	200.2	178.2	183.5	164.5	179.2	165.5	197.0	203.3	203.3	192.6
Total	1446.2	1355.5	1656.7	1603.8	1889	1699.0	1461.3	1581.3	1530.5	1417.4	1760.2	1912.5	1495.9	1527.7	1590.0	1964.9	1839.8	1893.1	1804.7	1757.4	1750	1928.7	2051.4	2127.5	1945.5
Mean	144.62	135.55	165.67	160.38	188.90	169.90	146.13	158.13	153.05	141.74	176.02	191.25	149.59	152.77	159.00	196.49	183.98	189.31	180.47	175.74	174.50	192.87	205.14	212.75	194.55

Plant height (cm)

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	169.90	146.13	158.13	153.05	141.74	**768.95**	153.79
B	176.02	191.25	149.59	152.77	159.00	**828.63**	165.73
C	196.49	183.98	189.31	180.47	175.74	**925.99**	185.20
D	175.00	192.87	205.14	212.75	194.55	**980.31**	196.06
E	144.62	135.55	165.67	160.38	188.90	**795.12**	159.02
Total	**862.03**	**849.78**	**867.84**	**859.42**	**859.93**	**4,299.00**	

(ANOVA Table)

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**1,0947.99**			
Block	**4**	**34.04**	**8.51**	**0.03**	**3.01**
Treatment	**4**	**6,462.51**	**1615.63**	**5.81**	**3.01**
Error	**16**	**4,451.44**	**278.22**		

Mean Table

ıTMENTS

ıf poultry dropping (E)

ıltry dropping (A)

ıultry dropping (B)

ɔultry dropping (C)

ɔultry dropping (D)

LSD at 5% significant level =22.36

APPENDIX II

Number of Nodes

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
No./Rep	E1	E2	E3	E4	E5	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5
1	12	13	12	12	15	14	14	13	13	14	15	13	14	14	14	16	14	14	15	14	16	15	15	14	15
2	13	13	12	13	14	13	14	14	13	14	15	12	15	14	14	14	13	12	14	15	16	16	15	14	14
3	12	14	13	12	15	13	14	13	14	13	13	12	13	13	15	13	16	15	15	15	15	16	14	14	15
4	14	13	14	13	13	15	12	13	12	15	14	12	14	15	14	16	15	15	12	14	14	14	16	13	15
5	13	12	12	13	13	13	13	14	13	12	12	15	14	12	13	15	14	14	16	15	16	15	15	15	16
6	12	14	13	14	12	14	12	15	13	14	14	13	15	13	15	14	15	15	15	13	15	14	13	14	16
7	14	14	13	12	13	12	14	14	12	15	15	14	14	14	15	14	13	13	14	14	15	16	14	15	15
8	12	12	15	12	13	14	15	14	13	12	13	13	14	15	14	13	16	16	15	15	14	15	13	14	15
9	13	14	14	14	13	14	12	13	12	13	12	14	13	12	15	14	15	15	14	15	14	16	13	14	16
10	12	12	15	13	14	12	13	14	14	14	14	15	15	13	13	15	12	14	16	16	15	15	14	13	15
Total	127	131	133	128	135	134	133	137	129	136	137	133	141	135	142	145	143	143	146	146	150	152	142	140	161
Average	12.7	13.1	13.3	12.8	13.5	13.4	13.3	13.7	12.9	13.6	13.7	13.3	14.1	13.5	14.2	14.5	14.3	14.3	14.6	14.6	15	15.2	14.2	14	16.1

Number of Nodes

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	13.4	13.3	13.7	12.9	13.6	**66.9**	13.38^D
B	13.7	13.3	14.1	13.5	14.2	**68.8**	13.76^C
C	14.5	14.3	14.3	14.6	14.6	**72.3**	14.46^B
D	15.0	15.2	14.2	14.0	16.1	**74.5**	14.90^A
E	12.7	13.1	13.3	12.8	13.5	**65.4**	13.08^E
Total	**69.3**	**69.2**	**69.6**	**67.8**	**72.0**	**347.9**	

(ANOVA) Table

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	24	15.73			
Block	4	1.85	0.46	2.88	3.01
Treatment	4	11.37	2.84	17.75	3.01
Error	16	2.51	0.16		

LSD at 5% significant level= 0.53

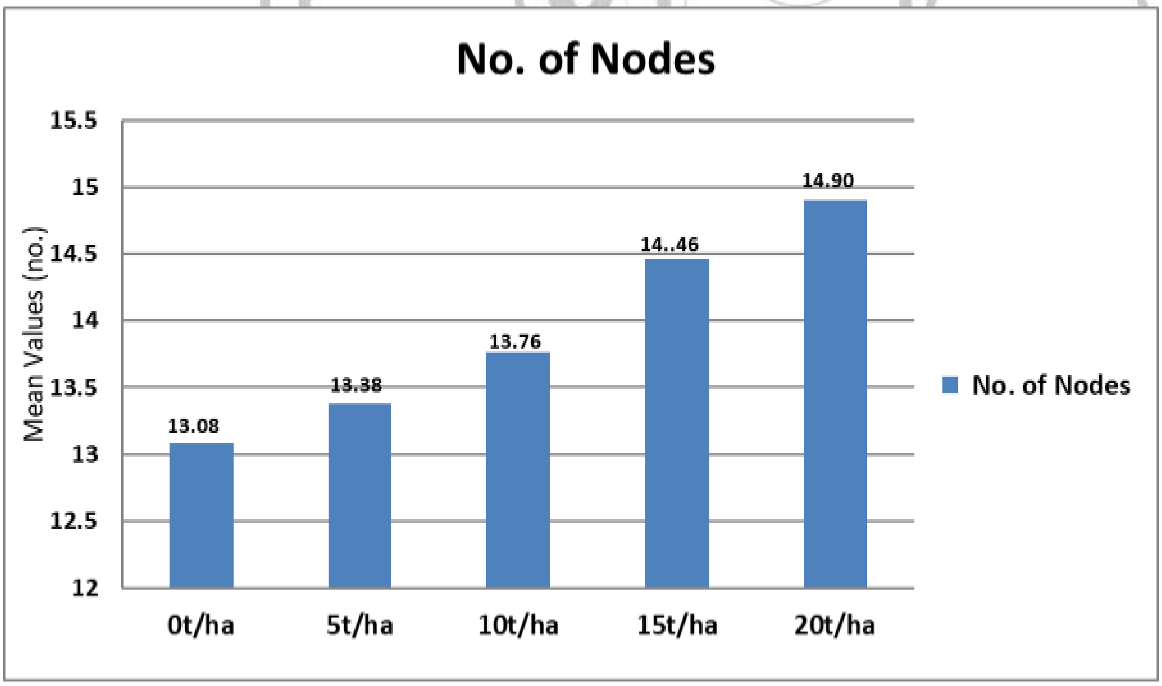

Fig 7: Bar chart showing number of Nodes of various treatments used.

APPENDIX III

Numbers of Internodes

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
No.Rep	**E1**	**E2**	**E3**	**E4**	**E5**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**	**D1**	**D2**	**D3**	**D4**	**D5**
1	13	13	14	13	15	12	12	14	14	13	14	15	15	15	14	13	14	13	13	14	15	16	16	13	15
2	13	13	12	13	14	13	14	13	14	12	15	11	14	14	15	14	15	15	14	15	14	14	14	15	16
3	12	14	13	14	15	14	13	12	13	13	14	14	12	13	15	16	13	15	14	15	16	13	15	13	15
4	13	13	14	14	13	14	12	14	12	14	14	14	13	15	14	14	16	15	14	14	15	15	14	14	15
5	14	12	15	11	12	13	13	14	13	13	15	15	15	15	13	15	13	13	13	13	16	15	13	14	15
6	13	14	11	14	14	12	14	13	12	12	13	13	11	14	14	14	16	14	14	13	14	14	14	15	14
7	14	14	13	14	13	13	13	12	14	14	13	14	12	13	13	14	13	16	15	12	14	13	15	14	13
8	15	13	14	15	13	14	12	11	13	13	14	15	11	14	11	14	14	13	12	13	13	13	15	14	14
9	13	15	14	13	15	13	13	12	14	14	15	13	13	13	14	15	14	13	13	14	12	14	14	15	15
10	14	13	15	12	13	12	14	14	13	13	14	14	14	15	13	14	15	14	16	15	13	15	15	13	14
Total	134	134	135	133	137	130	130	129	132	131	139	138	140	141	136	143	143	141	138	138	142	142	145	140	146
Average	13.4	13.4	13.5	13.3	13.7	13	13	12.9	13.2	13.1	13.9	13.8	14	14.1	13.6	14.3	14.3	14.1	13.8	13.8	14.2	14.2	14.5	14	14.6

Number of Internodes

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	13.0	13.0	12.9	13.2	13.1	**65.2**	13.04^{E}
B	13.9	13.8	14.0	14.1`	13.6	**69.4**	13.88^{C}
C	14.3	14.3	14.1	13.8	13.8	**70.3**	14.06^{B}
D	14.2	14.2	14.5	14.0	14.6	**71.5**	14.30^{A}
E	13.4	13.4	13.5	13.3	13.7	**67.3**	13.46^{D}
Total	**68.8**	**68.7**	**69.0**	**68.4**	**68.8**	**343.7**	

(ANOVA) Table

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**5.8**			
Block	**4**	**0.04**	**0.01**	**0.20**	**3.01**
Treatment	**4**	**5.02**	**1.26**	**25.20**	**3.01**
Error	**16**	**0.74**	**0.05**		

LSD at 5% significant level= 0.30

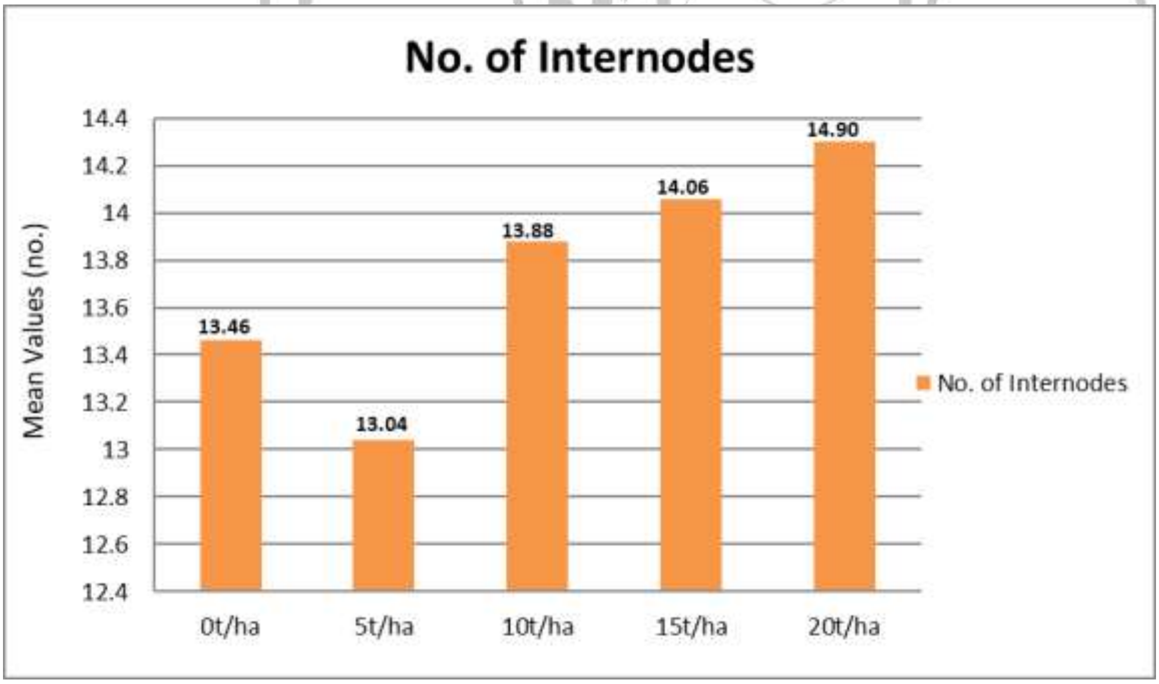

Fig 8: Bar chart showing number of internodes of various treatments used.

APPENDIX IV

Length of cob (cm)

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
Num/ Rep	**E1**	**E2**	**E3**	**E4**	**E5**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**	**D1**	**D2**	**D3**	**D4**	**D5**
1	10.5	10.1	12.8	15.0	11.8	10.8	12.6	14.5	10.1	14.0	12.8	11.2	11.5	12.3	10.0	12.2	14.5	15.0	11.0	16.5	14.1	13.5	15.1	11.0	14.7
2	12.4	11.3	11.5	10.4	10.4	11.2	11.2	10.2	11.4	11.4	13.6	12.2	12.3	13.6	16.0	11.9	10.4	10.0	13.5	16.3	14.5	12.0	13.0	18.5	16.0
Total	**22.90**	**21.40**	**24.30**	**25.40**	**22.20**	**22.00**	**23.80**	**24.70**	**21.50**	**25.50**	**26.40**	**23.40**	**23.80**	**25.90**	**26.00**	**24.10**	**24.90**	**25.00**	**24.50**	**32.80**	**28.60**	**25.50**	**28.10**	**29.50**	**30.70**
Mean	**11.45**	**10.70**	**12.15**	**12.70**	**11.10**	**11.00**	**11.90**	**12.35**	**10.75**	**12.70**	**13,20**	**11.70**	**11.90**	**12.95**	**13.00**	**12.05**	**12.45**	**12.50**	**12.25**	**16.40**	**14.45**	**12.75**	**14.05**	**14.75**	**15.35**

Length of cob (cm)

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	11.00	11.90	12.35	10.75	12.70	**58.70**	11.74D
B	13,20	11.70	11.90	12.95	13.00	**62.75**	12.55C
C	12.05	12.45	12.50	12.25	16.40	**65.65**	13.13B
D	14.45	12.75	14.05	14.75	15.35	**71.20**	14.24A
E	11.45	10.70	12.15	12.70	11.10	**58.10**	11.62E
Total	**62.00**	**59.50**	**62.95**	**63.40**	**68.55**	**316.40**	

(ANOVA) Table

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**47.90**			
Block	**4**	**8.76**	**2.19**	**2.21**	**3.01**
Treatment	**4**	**23.29**	**5.82**	**5.88**	**3.01**
Error	**16**	**15.85**	**0.99**		

LSD at 5% significant level= 1.33

APPENDIX V

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
Num/ Rep	**E1**	**E2**	**E3**	**E4**	**E5**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**	**D1**	**D2**	**D3**	**D4**	**D5**
1	8.80	9.60	9.00	10.50	9.20	10.00	10.20	9.30	10.40	9.50	10.80	11.00	9.00	10.50	10.40	11.20	10.20	9.50	12.00	11.50	11.20	10.60	11.60	10.50	10.40
2	10.40	9.10	9.50	7.60	9.10	11.50	10.20	10.20	9.50	11.10	10.80	11.50	11.30	11.50	11.00	11.00	10.20	11.50	9.50	10.60	11.60	10.50	10.00	10.00	10.60

Total	**18.30**	**18.10**	**18.50**	**18.70**	**19.20**	**21.50**	**22.40**	**19.50**	**19.90**	**20.60**	**21.60**	**22.50**	**20.30**	**22.00**	**21.40**	**22.20**	**20.40**	**21.00**	**21.50**	**22.10**	**22.80**	**21.10**	**21.00**	**21.50**	**21.00**
Mean	**9.60**	**9.35**	**9.25**	**9.05**	**9.15**	**10.75**	**10.20**	**9.75**	**9.95**	**10.30**	**10.80**	**11.25**	**10.15**	**11.00**	**10.70**	**11.10**	**10.20**	**10.50**	**10.75**	**11.50**	**11.40**	**10.55**	**10.50**	**10.75**	**10.50**

Girth of cob (cm)

Girth of cob (cm)

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	10.75	10.20	9.75	9.95	10.30	**50.95**	10.19^{D}
B	10.80	11.25	10.15	11.00	10.70	**53.90**	10.78^{C}
C	11.10	10.20	10.50	10.75	11.50	**54.05**	10.81^{A}
D	11.40	10.55	10.50	10.75	10.50	**53.70**	10.74^{B}
E	9.60	9.35	9.25	9.05	9.15	**46.40**	9.28^{E}
Total	**53.65**	**51.55**	**50.15**	**51.50**	**52.15**	**259.00**	

(ANOVA) Table

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**11.64**			
Block	**4**	**1.28**	**0.32**	**2.91**	**3.01**
Treatment	**4**	**8.59**	**2.15**	**19.55**	**3.01**
Error	**16**	**1.77**	**0.11**		

LSD at 5% significant level= 0.44

APPENDIX VI
Number of Kernel Row per cob

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
Num/ Rep	**E1**	**E2**	**E3**	**E4**	**E5**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**	**D1**	**D2**	**D3**	**D4**	**D5**
1	8	10	12	12	12	12	12	12	14	8	12	12	12	12	10	10	12	12	12	12	14	13	14	12	11
2	10	8	11	12	12	10	12	8	10	10	12	12	10	8	14	12	14	14	12	10	12	12	12	11	12
Total	**18**	**16**	**23**	**24**	**24**	**22**	**24**	**20**	**24**	**18**	**24**	**24**	**22**	**20**	**24**	**22**	**26**	**26**	**24**	**22**	**26**	**25**	**26**	**23**	**23**

Mean	**9.00**	**9.00**	**11.50**	**12.00**	**12.00**	**11.00**	**12.00**	**10.00**	**12.00**	**9.00**	**12.00**	**12.00**	**11.00**	**10.00**	**12.00**	**11.00**	**13,00**	**13.00**	**12.00**	**11.00**	**13.00**	**12.50**	**13.00**	**11.50**	**11.50**

Number of Kernel Row per Cob

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	11.00	12.00	10.00	12.00	9.00	**54.00**	10.80[D]
B	12.00	12.00	11.00	10.00	12.00	**57.00**	11.40[C]
C	11.00	13,00	13.00	12.00	11.00	**60.00**	12.00[B]
D	13.00	12.50	13.00	11.50	11.50	**61.50**	12.30[A]
E	9.00	9.00	11.50	12.00	12.00	**53.50**	10.70[E]
Total	**56.00**	**58.50**	**58.50**	**57.50**	**55.50**	**286.00**	

(ANOVA) Table

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**36.16**			
Block	**4**	**1.56**	**0.39**	**0.25**	**3.01**
Treatment	**4**	**10.06**	**2.52**	**1.65**	**3.01**
Error	**16**	**24.54**	**1.53**		

LSD at 5% significant level= 1.66

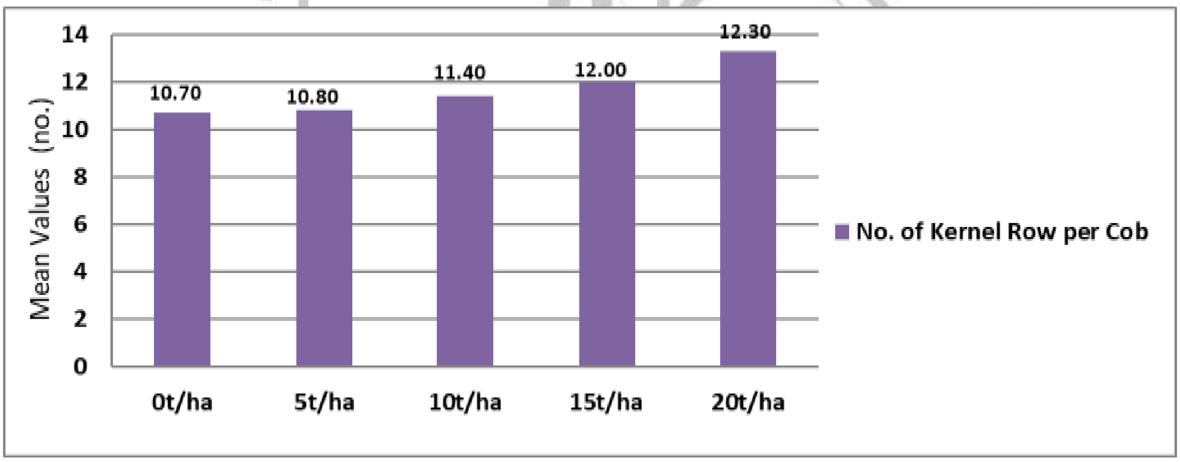

Fig 9: Bar chart showing difference in kernel rows per cob.

APPENDIX VII

Leaf Area (cm)

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
/R	E1	E2	E3	E4	E5	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5
1	342.0	181.0	188.0	223.4	325.5	405.4	317.1	133.4	260.7	175.3	345.4	475.2	337.8	395.6	475.5	280.7	252.9	233.8	468.1	459.2	375.6	386.7	174.6	358.0	439.9
2	197.6	322.4	269.1	306.4	249.1	168.5	278.8	200.4	364.5	215.7	481.8	332.8	389.3	318.0	271.7	410.9	301.0	376.9	390.6	455.0	417.0	444.6	395.2	293.9	367.4
3	292.4	243.0	177.4	230.1	555.3	255.6	353.1	249.1	145.9	290.6	356.0	498.3	389.7	453.6	387.6	393.1	407.6	324.6	520.7	337.8	567.2	328.4	479.3	455.7	380.4
4	251.0	311.3	266.0	207.2	388.0	630.2	143.2	342.7	314.1	290.0	277.6	285.1	244.9	624.5	480.5	369.6	462.9	409.4	515.5	301.5	560.7	328.9	350.9	236.7	236.0
5	381.7	403.4	271.8	367.7	473.7	221.9	226.6	211.2	139.0	332.8	428.4	376.9	357.8	457.5	241.2	248.7	445.7	371.2	512.1	494.2	434.2	324.5	587.9	542.5	254.1
6	229.3	229.1	196.0	246.1	271.6	292.9	256.2	298.0	180.3	254.3	342.2	485.6	269.8	400.4	354.4	394.0	318.0	312.5	395.9	414.0	390.5	433.8	482.4	371.0	386.6
7	406.6	287.6	231.4	225.4	240.7	196.7	238.1	255.9	246.7	162.7	338.9	211.8	488.8	441.8	363.7	411.9	398.5	350.5	501.6	463.4	468.1	473.1	398.8	517.8	432.9
8	298.0	258.3	230.4	284.9	464.0	493.6	258.3	191.2	356.3	181.2	428.8	433.1	369.1	545.7	328.0	369.0	279.3	380.3	445.7	476.9	513.3	433.9	514.2	382.4	267.0
9	409.3	326.4	221.9	333.0	473.7	446.2	244.6	194.9	248.4	181.1	291.0	217.4	385.6	493.6	439.0	371.5	392.7	456.1	529.4	390.9	363.8	482.3	372.0	334.3	517.2
10	253.5	142.2	267.6	230.6	304.8	448.7	246.9	332.8	317.2	262.9	306.9	409.2	298.0	458.2	304.2	287.0	505.5	542.7	466.5	361.8	302.7	364.8	562.1	379.7	289.3
otal	2679.7	2704.7	2319.6	2654.8	3746.4	3559.7	2562..9	2409.6	2573.1	2346.6	3597.0	3725.4	3536.2	4588.9	3645.8	3536.4	3764.1	3758.0	4746.1	4154.7	4393.1	4001.0	4317.4	3872.0	3570.8
ean	268.0	270.5	232.0	265.5	374.6	356.0	256.3	241.0	257.3	234.7	359.7	372.5	353.6	458.9	364.6	353.6	376.4	375.8	474.6	415.5	439.3	400.1	431.7	387.2	357.1

Leave area (cm)

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	356.0	256.3	241.0	257.3	234.7	**1345.3**	269.1[E]
B	359.7	372.5	353.6	458.9	364.6	**1909.3**	381.9[C]
C	353.6	376.4	375.8	474.6	415.5	**1995.9**	399.2[B]
D	439.3	400.1	431.7	387.2	357.1	**2015.4**	405.1[A]
E	268.0	270.5	232.0	265.5	374.6	**1410.6**	282.1[D]
Total	**1776.6**	**1675.8**	**1634.1**	**1843.5**	**1746.5**	**8676.5**	

(ANOVA) Table

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**129,551.9**			
Block	**4**	**5,464.0**	**1,366.0**	**0.59**	**3.01**
Treatment	**4**	**86,834.9**	**21,708.7**	**9.32**	**3.01**
Error	**16**	**37,253.0**	**2,328.3**		

LSD at 5% significant level=64.70

APPENDIX VIII

Yield per treatment (ton/ha)

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	0.67	0.57	0.86	0.71	0.76	**3.57**	0.71
B	0.71	0.81	0.57	1.14	0.71	**3.94**	0.79
C	1.05	0.67	1.00	0.81	0.52	**4.05**	0.81
D	0.76	0.91	0.95	0.86	0.57	**4.05**	0.81
E	0.62	0.67	0.48	0.71	0.48	**2.96**	0.59
Total	**3.81**	**3.36**	**3.86**	**4.23**	**3.04**	**18.57**	

(ANOVA)

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**0.74**			
Block	**4**	**0.16**	**0.04**	**1.60**	**3.01**
Treatment	**4**	**0.18**	**0.05**	**2.00**	**3.01**
Error	**16**	**0.40**	**0.025**		

Mean Table

TREATMENTS	MEAN (t/ha)
Control 0t/ha of poultry dropping €	0.59[D]
5t/ha of poultry dropping (A)	0.71[C]
10t/ha of poultry dropping (B)	0.79[B]
15t/ha of poultry dropping (C)	0.81[A]
20ton/hec of poultry dropping (D)	0.81[A]

LSD at 5% significant level= 0.21

APPENDIX IX

Weight of 1000 kernel (grams)

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	150.35	163.49	164.30	159.13	172.39	**809.66**	161.93
B	160.43	173.32	184.95	175.33	194.54	**888.57**	177.71
C	183.73	195.44	183.39	203.15	252.11	**1,017.82**	203.56
D	250.00	198.42	205.31	210.53	183.22	**1,047.48**	209.50
E	135.32	133.45	149.26	125.83	150.05	**693.91**	138.78
Total	**879.83**	**864.12**	**887.21**	**873.97**	**952.31**	**4,451.44**	

(ANOVA)

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	**24**	**25,377.38**			
Block	**4**	**981.89**	**245.47**	**0.55**	**3.01**
Ttreatment	**4**	**17,206.94**	**4301.74**	**9.58**	**3.01**
Error	**16**	**7,188.55**	**449.29**		

Mean Table

TREATMENTS	MEAN (grams)

Control 0ton/hec of poultry dropping (E)	138.78^{E}
5ton/hec of poultry dropping (A)	161.93^{D}
10ton/hec of poultry dropping (B)	177.71^{C}
15ton/hec of poultry dropping (C)	203.56^{B}
20ton/hec of poultry dropping (D)	209.50^{A}

LSD at 5% significant level= 28.42

APPENDIX X

Number of kernel from two samples in each experimental plot.

	0t/ha					5t/ha					10t/ha					15t/ha					20t/ha				
Num/ Rep	**E 1**	**E 2**	**E 3**	**E 4**	**E 5**	**A 1**	**A 2**	**A 3**	**A 4**	**A 5**	**B 1**	**B 2**	**B 3**	**B 4**	**B 5**	**C1**	**C2**	**C 3**	**C4**	**C 5**	**D 1**	**D 2**	**D 3**	**D 4**	**D 5**
1	92	103	114	173	185	162	137	143	188	123	144	309	103	115	179	185	217	263	382	373	253	325	213	352	283
2	142	113	148	133	159	193	212	111	148	132	138	257	164	218	203	304	253	203	259	295	233	267	298	223	295
Total	**234**	**216**	**321**	**306**	**344**	**355**	**349**	**254**	**336**	**255**	**282**	**566**	**267**	**333**	**382**	**489**	**470**	**466**	**641**	**668**	**486**	**592**	**511**	**575**	**578**
Mean	**117.0**	**108.0**	**131.0**	**163.0**	**172.0**	**177.5**	**174.5**	**127.0**	**168.0**	**127.5**	**141.0**	**283.0**	**133.5**	**166.5**	**191.0**	**244.5**	**235.0**	**233.0**	**320.5**	**334.0**	**243.0**	**296.0**	**255.5**	**287.5**	**289.0**

Number of Kernel

Treatment/ Block	I	II	III	IV	V	Total	Mean
A	177.5	174.5	127.0	168.0	127.5	**774.5**	154.9
B	141.0	283.0	133.5	166.5	191.0	**915.0**	183.0
C	244.5	235.0	233.0	320.5	334.0	**1,367.0**	273.4
D	243.0	296.0	255.5	287.5	289.0	**1,371.0**	274.2
E	117.0	108.0	131.0	153.0	172.0	**681.0**	136.2
Total	**923.0**	**1096.5**	**880.0**	**1095.5**	**1113.5**	**5,108.5**	

(ANOVA)

Treatment/ Block	D.F Degree of freedom	SS Sum Squared	MS Mean squared	Fcal F calculated	Ftab(0.05) F tabulated
Total	24	117,890.36			
Block	4	9,857.86	2,464.47	1.79	3.01
Treatment	4	85,962.36	21,490.59	15.58	3.01
Error	16	22,070.14	1,379.38		

TREATMENTS	MEAN
Control 0t/ha of poultry dropping (E)	136.2^{E}
5t/ha of poultry dropping (A)	154.9^{D}
10t/ha of poultry dropping (B)	183.0^{C}
15t/ha of poultry dropping (C)	273.4^{B}
20t/ha of poultry dropping (D)	274.2^{A}

LSD at 5% significant level= 49.80