COMPARATIVE EFFECT OF POULTRY MANURE (PM) AND GRADED LEVELS OF NPK ON FOLIAGE YIELD OF GONGRONEMA *LATIFOLIA* BENTH (ASCLEPIADECEAE) ACCESSIONS CULTIVATED IN NIGERIA΄S SOUTHERN GUINEA SAVANNA

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Abstract
Field *trials were conducted during 20014 and 20016 farming seasons at the experimental field of Niger State College of Education Minna (9^0 45^1 N; 6^0 07^1 E) in the Southern Guinea savanna agro-ecological zone of Nigeria to determine the combined effect of organic and inorganic fertilizers on growth and yield of Gongronema, Three accessions of Gongronema (ENS-01-Ikem, ENS-02-Orba and ENS-03-Agbani), five rates of inorganic manure (0kg, 100kg, 200kg, 300kg and 4000kg of NPK/ha^{-1}) and an optimum rate of organic manure (15t ha^{-1}) were used in a 3 x 5 factorial randomized complete block design (RCBD) experiment. The following growth and yield parameters were measured: Vine length, vine fresh and dry weight, number of branches, number of leaves, leaf fresh and dry weight, root length, root fresh and dry weight plant fresh and dry weight. At maturity data were taken from the two inner row of each treatment at 8, 12 and 16 weeks after planting (WAP). ENS-01-Ikem gave significantly (P<0.05) best growth and foliage yield compared with other accessions across the selected WAP. The highest growth and foliage yield were recorded from plants that received combined application of 15t ha^{-1} organic manure and 300kgNPK/ha^{-1} of inorganic manure at 12 and 16 WAP (P<0.05), while the least growth and yield were obtained from treatment group applied with 0t ha^{-1}manure. Therefore, the combined application of poultry manure at 15t ha^{-1} and 300kgNPK/ha^{-1} of inorganic manure and the choice of ENS-03-Abgani were observed as the optimum agronomic intervention to obtain the highest growth and yield of Gongronema*

Keywords: Poultry Manure, NPK, Foliage and Gongronema

Introduction
Gongronema *latifolium* Benth, belong to the family Asclepiadacare. It is a forest leafy vegetable and an edible nutritional/medicinal plant mostly found in the rain forest zone of Nigeria and other Tropical African countries (Eze & Nwansuma, 2013). Some 250 genera and over 200 species are widely spread in Tropical and subtropical region of the world especially in Africa and Southern America, with a moderate representation in Northern and Southern Asia (Sakihama et al., 2002; Ugochukwu & Babdy, 2003; Edet *et al*., 2009). The plant produces white latex and yellow flowers and can be propagated by seed and stem cutting (Edim *et al.,* 2012). Gongronema *latifolium* is known by the Ikales of Ondo State of Nigeria as" itaji" as reported by Marebise and Fafunso (2015). It is locally called "utasi" by the Efiks, Ibibios and Quas; "utazi" by the Igbos and "arokeke" by the Yorubas in Nigeria (Okolie *et al*., 2008 and Udoh, 2012). According to the Akan Asantes of Ghana it is known as Kwutu Nsurogya, the Serers of Senegal call it Gasub, while to the Kissi of Sieria Leone, it is refered to as Ndab-Poloe as reported by Morebise *et al.* (2006). The Efiks and Quas of Calabar use *G. latifolium* crude leaf extract for treating of malaria, diabetes, hypertension, and as laxative. It is also being used as a spice and vegetable and as part of preparation in the traditional folk medicine (Ugochukwu & Babady, 2006). Furthermore, the crude leaf extract of this is being used for maintaining healthy blood

glucose levels, promotion of hormones associated with that fertility, treatment of dysentery, malaria, worms, cough and high blood pressure (Agbo *et al.*, 2005). Reports from scientific studies have established the hypoglycaemic, hypolipidaemic and antioxidative effects of both the aqueous and ethanol extracts of *G. latifolium* leaf (Ogundipe *et al.*, 2003).

The recent interest in organomineral fertilizers arose from high cost and scarcity of inorganic fertilizer as well as the fast release of nutrients rapidly by leaching in either porous or heavy soil. Also, the huge amount of organic fertilizers required for crop production and the problem of handling bulkiness of the organic fertilizers. Makinde *et al*. (2010) advocated an integrated use of both organic manure and inorganic fertilizers for the promotion of adequate supply of plant nutrient to sustain maximum crop productivity and profitability while minimizing environmental impact from nutrient use. Apart from the promotion of crop production, the use of organomineral fertilizer is a low input technology of improving the nutrient status of tropical soils for sustainable crop production. The organomineral fertilizer combine the attributes of both the organic and inorganic fertilizers (Ayeni, 2008). Studies by Adeoye *et al*. (2014), Fagbola and Ogungbe (2007) recorded that the use of organomineral fertilizer enhanced better growth of plants including *Amaranthus Cruentus,* maize and pepper which are similar to the Gongronema latifolia. Akande *et al*. (2003) also reported that combined use of ground rock phosphate with poultry manure significantly improved growth and yield of Okra (*Abelmoschus esculentus* L Moench) compared with the application of each material separately. Furthermore, according Akanbi and Togun (2005) the combined application of 4 Mt/ha of maize straw compost and N mineral fertilizer at 30 kg/ha improved plant growth and gave higher maize yields compared with other combinations.

Therefore, this present study hypothesized that combine application of both poultry manure and the inorganic fertilizer will give optimum plant growth and foliage yield of Gongronema *latifolia* Benth in the Savanna ecology of Nigeria.

Objective

The objective of this study is to determine the best combination rate of poultry and NPK fertilizer that will give optimum plant growth and foliage yield of Gongronema *latifolia* Benth in the Savanna ecology of Nigeria.

Materials and Methods

Experimental Site

The experiment was conducted at the experimental field of Niger State College of Education Minna, during 2014 and 2016 cropping seasons. Minna is located in the Southern Guinea Savanna lies between latitude 9^0 37 North and Longitude 6^0 32 East.

The soil at trial site has been classified as sandy loam in texture with bulk density of 1.460 m^{-1} (Ayotade & Fagade, 1993). The study location has an average rainfall of 1223 mm and mean temperature of 24^0 C– 34^0C.

Experimental design

Two factors were tested in this trial: Accessions of G. latifolia and NPK fertilizer.
Three accessions that were used are:

a. ENS-02-Orba
b. ENS-03-Agbani

c. ENS-01- Ikem

Five rates of NPK:

a. 0kgNPK/ha
b. 100kgNPk/ha
c. 200kgNPK/ha
d. 300kgNPK/ha
e. 400kgNPK/ha

The treatments were 3 x 5 combination that was laid out in a Randomized Complete Block Design with three replications. Each Block accommodated 15 treatment combinations, space 1m apart. The experimental size was 18m x 75m (1350m^2)

Cultural Practices

Land preparation

In all the two years, the experimental field was cleared of weed and debris, ploughed, harrowed and ridges were done manually by the use of local hoe. The land was divided into 3 blocks and each with numbers of treatments. The gross plot size was 4m x 5m (20m^2) spaced 1m x 1m. Each plot consisted of four rows of 4m long ridges and were spaced 1m apart, while the net plot size was 2.5m x 4m (10 m^2) consisting of two middle ridges where data were collected. Standard nursery media of 3:2:1 (top soil, manure and sand) was used to fill in perforated black polythene bags and watered before seeds were sown. Seedlings were transplanted six weeks later, while on the field, seedlings were transplanted at planting spacing of 1m within and between seedlings of different rows. Each row has 4 plants stand and one plant per stand (16 plants stand per treatment).

Application of Organic and Inorganic Fertilizer

Each treatment received basal application of optimum poultry manure immediately after transplanting and NPK fertilizer was applied (band application) at the rate of 0, 5, 10, 15 and 20 tones/ha one month after planting.

Data Collection

Growth and foliage parameters

At maturity data were taken from the two-inner row of each treatment, 8 weeks after transplanting at four weeks interval (8, 12 and 16)

Vine length: This was measured from the base to the tip of a plant using a tape rule.
Vine fresh and dry weight: The leaves were separated from individual vine and the fresh weight was taken using electric metler balance. The individual vine was put into brown paper envelop and dried at 60^0 C to constant weight using an electric oven. The dry weight of each sample was recorded using an electric metler balance

Number of branches per plant
Number of leaves per plant: Leaves were separated from individual plant and then counted.
Leaf fresh and dry weight: The leaves were separated from individual vine and the leaf fresh weight was taken using electric metler balance. The fresh leaves were be put into brown paper envelop and dried at 60^0 C to constant weight using an electric oven. The dry weight of each sample was recorded using an electric metler balance.

Root length (longest root): This was taken using tape rule

Root fresh and dry weight: Roots were separated from individual vine and the root fresh weight was taken using electric metler balance. The fresh roots were put into brown paper envelop and dried at 60^0 C to constant weight using an electric oven. The dry weight of each sample was recorded using an electric metler balance.

Plant fresh weight: This was measured per plant using weighing scale.

Plant dry weight: The fresh plants were sun dried for period of 2-3 weeks and later put into brown paper envelope and dried at 60^{0c} to constant weight and the dry weight of plant were taken using weighing scale

Analysis of Data

All data obtained were subjected to statistical analysis to test treatment effects for significance differences using Genstat statistical package (2010). The means were compared using least significant difference (LSD).

Result

Number of branches per plant

Number of branches produced by ENS-03-Agbani significantly (P<0.05) outnumbered those obtained from other accessions at 16 WAP in 2014. Furthermore, at 8 and 12 WAP in 2014 and across harvesting stages in, numbers of branches produced were statistically similar among accessions. There was general increase on number of branches per plant among different rates of NPK + 15t h^{-1} PM applied up to 300kg h^{-1} NPK + 15t h^{-1} PM and beyond this point a declined was recorded. Plant that received 300kg h^{-1} NPK + 15t ha^{-1} PM produced significantly more yield than other treatment combinations in 2014 and 2016 planting seasons (P<0.05). Plant applied with 200kg and 400kg ha^{-1} NPK + 15t ha^{-1} PM gave statistically comparable number of branches per plant and were significantly higher than those from 100kg ha^{-1} of NPK + 15t ha^{-1} PM and zero treatment in 2014 (P<0.05). However, in 2016, 400kg ha^{-1} NPK + 15t ha^{-1} PM produced significantly more number of branches than those from 100 and 200kg h ha^{-1} NPK+15t ha^{-1} PM (P<0.05) (Tables 1).

Number of leaves per plant

Number of leaves produced by ENS-03-Agbani significantly outnumbered those obtained from other accessions at 16 WAP for the year 2014 (P<0.05). Furthermore, at 8 and 12 WAP in the year 2014 and at 8, 12 and 16 WAP in the year 2016, number of leaves produced were statistically similar among accessions. In both cropping seasons, Plant that received 300kg ha^{-1} of NPK + 15t ha^{-1} of PM produced significantly more leaves yield than other treatment combinations (P<0.05). Plant applied with 200kg and 400kg ha^{-1} of NPK + 15t ha^{-1} of PM gave statistically comparable number of leaves per plant and were significantly higher than those from 100kg ha^{-1} of NPK +15t ha^{-1} of PM and zero treatment in 2014 (P<0.05). However, in 2016, 400kg ha^{-1} of NPK + 15t ha^{-1} of PM across harvesting stages gave significantly more leaves yield than 100kg and 200kg ha^{-1} of NPK + 15t ha^{-1} of PM (Table 2).

At 16 WAP, ENS-02–Orba and ENS-03-Agbani produced significantly higher number of leaves with the application of 300kg ha^{-1} of NPK + 15t ha^{-1} of PM than other accessions and treatment combinations (P<0.05). ENS -01-Ikem at 300kg h^{-1} of NPK + 15t ha^{-1} PM and ENS-02-Orba and ENS-03-Agbani at 400kg ha^{-1} of NPK + 15t ha^{-1} of PM produced comparable leaves and were significantly higher than 100 and 200kg ha^{-1} of NPK + 15t ha^{-1} of PM (Table 3).

Fresh leaves weight (g)
At 16 WAP, ENS-03-Agbani significantly outweighed other accessions in fresh leaves weight in the year 2014 (P<0.05). However, at 8 and 12 WAP in the year 2014 and across the harvesting stages in the year 2016, accessions produced statistically similar leaves weight. 15t ha^{-1} of PM + 300kg ha^{-1} of NPK produced the heaviest leaves weight while a decreased leaves weight was observed with the application of 15t ha^{-1} of PM + 400kg ha^{-1} of NPK. At 8, 12 and 16 WAP in both cropping seasons, the application of 15t ha^{-1} of PM + 300kg ha^{-1} of NPK significantly produced the highest fresh leaves weight in comparison with those of other treatment combinations (Table 4).

Dry leaves weight (g)
At 16 WAP, ENS-03-Agbani significantly outweighed other accessions in dry leaves weight in the year 2014 (P<0.05). However, at 8 and 12 WAP in the year 2014 and across harvesting stages in the year 2016, accessions produced similar leaves weight. In 2014 and 2016 planting seasons, at 8, 12 and 16 WAP, the application of 15t ha^{-1} PM + 300kg ha^{-1} NPK significantly (P<0.05) produced the highest dry leaves weight compared with other treatment combinations. In 2014, 15t ha^{-1} PM + 200kg ha^{-1} NPK produced significantly higher fresh weight dry leaves at 12 and 16 WAP than plants that received 15t ha^{-1} PM + 100kg ha^{-1} NPK and 400kg ha^{-1} NPK (P<0.05). Furthermore, the application of 15t ha^{-1} PM + 200kg ha^{-1} NPK and 400kg ha^{-1} NPK produced higher dry leaves weigh at 8 WAP than 15t ha^{-1} PM + 100kg ha^{-1} NPK and the control (P<0.05). However, in 2016 cropping season, 15t ha^{-1} PM + 400kg ha^{-1} NPK consistently produced significantly more leaves weight than those recorded from 15t ha^{-1} PM + 200 and 100kg ha^{-1} NPK (Table 5).

Vine length (m)
In 2014, at 8 and 12 WAP and in 2016 (Table 165) at 8 WAP, ENS-03-Agbani recorded a significantly (P<0.05) higher vine length than other accessions. Furthermore, in 2016, ENS-03-Agbani and ENS-02-Orba produced statistically similar vine length and were superior to ENS-01-Ikem at 8 and 12 WAP. In 2014, plants that were treated with 15t ha^{-1} PM + 300kg ha^{-1} NPK at 8 WAP gave significantly higher vine length than other treatment combinations (P<0.05). However, at 12 and 16 WAP 15t h^{-1} PM + 300kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} NPK in 2014 and across harvesting stages in 2016. similar vine length was produced and were significantly (P<0.05) higher than other treatment combinations. Irrespective of the harvesting stages, plant that received 15t ha^{-1} PM + 200kg ha^{-1} NPK were significantly (P<0.05) better than 15t ha^{-1} PM + 100kg ha^{-1} NPK and zero control (Table 6).

Fresh vine weight (g)
At 8 and 12 WAP in 2014 and at 12 WAP in 2016, ENS-03-Agbani produced significantly higher vine weight than other accessions with the weight following in the order of ENS-03-Agbani > ENS-02-Orba > ENS-01-Ikem (P<0.05). The application of optimum PM plus graded levels of NPK generally increased vine weight up to 15t ha^{-1} PM + 300kg ha^{-1} NPK while a decreased was recorded above this level of application. Plots treated with 15t ha^{-1} PM + 300kg ha^{-1}NPK outweighed other levels of application in vine weight across all harvesting stages and both cropping seasons (P<0.05). At 8 WAP in 2014 and across harvesting stages, vine weight was significantly higher at 15t ha^{-1} PM + 400kg ha^{-1} NPK than at 15t ha^{-1} PM + 200kg ha^{-1} NPK, 15t ha^{-1} PM + 100kg ha^{-1} NPK and zero control (P<0.05). However, in 2014, at 12 and 16 WAP, plant that received 15t ha^{-1} PM + 200kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} NPK gave similar vine weight. Three accessions used in this trial recorded similar fresh vine weight with

the application of 15t ha^{-1} PM + 300kg ha^{-1} NPK and were superior to other treatment combinations at 12 WAP in both cropping seasons (Table 7).

However, ENS-03-Agbani and ENS-02-Orba produced comparable vine weight at 15t ha^{-1} PM + 400kg ha^{-1} NPK and were significantly (P<0.05) heavier than ENS-01-Ikem at the same application rate. The least mean value was from zero treatment (Table 8).

Dry vine weight (g)

At 8 and 12 WAP during the year 2014 and at 8 WAP in the year 2016, ENS-03-Agbani produced higher vine weight than other accessions in the order ENS-03-Agbani > ENS-02-Orba > ENS-01-Ikem (P<0.05). However, at 16 WAP in 2014 cropping season and at 12 and 16 WAP in the year 2016, the vine weight yield was not different. The application of optimum PM plus graded levels of NPK generally increase vine weight up to 15t ha^{-1} PM + 300kg ha^{-1} NPK while a decreased was recorded above this level of application. Plots treated with 15t ha^{-1} PM + 300kg ha^{-1} NPK outweighed other levels of application in vine weight across all harvesting stages and both cropping seasons (P<0.05). At 8 WAP in the year 2014 and across the harvesting stages, vine weight was higher at 15t ha^{-1} PM + 400kg ha^{-1} NPK than at 15t ha^{-1} PM + 200kg ha^{-1} NPK, 15t ha^{-1}PM + 100kg ha^{-1} NPK (P<0.05). However, in 2014, at 12 and 16 WAP, plant that received 15t ha^{-1} PM + 200kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-} NPK gave similar vine weight (P<0.05). In 2014, three accessions used in the trial recorded similar dry vine weight with the application of 15t ha^{-1} PM + 300kg ha^{-1} NPK and were superior to other treatment combinations at 12 WAP (Table 9).

However, ENS-03-Agbani and ENS-02-Orba produced comparable vine weight at 15t ha^{-1} PM + 400kg ha^{-1} NPK and which was heavier than ENS-01-Ikem at the same application rate (P<0.05). The least mean value was from zero treatment (Table 10).

Root length (m)

ENS-03-Agbani, recorded a higher root length than other accessions at 12 and 16 WAP in 2014 cropping season (P<0.05). At 8 WAP in 2014 and across harvesting stages in 2016, accessions produced statistically comparable root lengths. Irrespective of harvesting stages and planting season, Plants treated with 15t ha^{-1} PM + 300kg ha^{-1} NPK had higher root length than other treatment combination (P<0.05). However, at 8 and 12 WAP, 15t ha^{-1} PM + 200kg h ha^{-1} NPK produced significantly (P<0.05) longer root length than 15t ha^{-1} PM + 400kg ha^{-1} NPK and 15t ha^{-1} PM + 100kg ha^{-1} NPK and no control in 2014 and at 8, 12 and 16 WAP in 2016, 15t ha^{-1} PM + 400kg ha^{-1} NPK gave significantly more length than 15t ha^{-1} PM + 200 and100kg ha^{-1} NPK and no control (Table 11).

Fresh root weight (g)

In 2014, at 12 and 16 WAP and 2016 (Table 183) at 16 WAP, ENS-03-Agbani produced significantly (P<0.05) more fresh root weight than other accessions. Statistically comparable fresh root weights were produced by accessions at 8 WAP in 2014 and at 8 and 12 WAP in 2016 planting seasons. The application of 15t ha^{-1} PM + 300kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} NPK gave similar fresh root weight and were significantly more other treatment combinations at 8 WAP in both cropping seasons (P<0.05). The reverse was the case, when plants that were treated with 15t ha^{-1} PM + 300kg ha^{-1} NPK at 12 and 16 WAP, produced significantly (P<0.05) higher fresh root weight than other treatment combinations. Furthermore, the application of 15t ha^{-1} PM + 400kg ha^{-1} NPK gave significantly (P<0.05) better root yield at 8 and 12 WAP than

15t ha^{-1} PM + 200kg ha^{-1} NPK ,15t ha^{-1} PM + 100kg ha^{-1} NPK and zero control. That the application of 0kg and 15t ha^{-1} PM +300kg ha^{-1} NPK at 16 WAP, consistently resulted in poorest and best fresh root weight respectively in all accessions (Table 12).

However, whether the values obtained for 15t ha^{-1} PM + 400kg ha^{-1} NPK were better than those of 15t ha^{-1} PM + 100kg ha^{-1} NPK, 15t ha^{-1} PM + 200kg ha^{-1} NPK and vice versa varied with accessions. For example, whereas no significant ($P>0.05$) differences were recorded between 15t ha^{-1} PM + 200kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} NPK in ENS-01-Ikem and ENS-03-Agbani, the fresh root weight at 15t ha^{-1} PM + 400kg ha^{-1} NPK were significantly ($P<0.05$) better than those at 15t ha^{-1} PM + 200kg ha^{-1} NPK in ENS-02-Orba (Table 13).

Dry root weight (g)

At 12 and 16 WAP, ENS-01-Ikem produced significantly ($P<0.05$) more dry root weight than other accessions in 2014 ($P<0.05$). However, in 2016, ENS-02-Orba performed significantly higher in dry weight than in other accessions. Statistically comparable dry root weights were produced by accessions at 8 WAP in 2014 and at 8 and 16 WAP in 2016. The application of 15t ha^{-1} PM + 300kg and 400kg ha^{-1} NPK in both cropping seasons across harvesting stages consistently produced significantly more dry root yield than what obtained from other treatment combinations ($P<0.05$). The application of 15t ha^{-1} PM + 200kg ha^{-1} NPK gave significantly ($P<0.05$) better root yield across harvesting stages and in both planting seasons than 15t ha^{-1} PM + 100kg ha^{-1} NPK and zero control (Table 14).

Fresh plant weight (g)

ENS-03-Agbani obtained significantly ($P<0.05$) higher fresh plant weight at 8, 12 and 16 WAP in 2014 planting season. However, in 2016 at 8 WAP ENS-01-Ikem and ENS-02-Orba were comparable in weight and significantly outweighed ENS-03-Agbani. Furthermore, at 16 WAP in 2016, ENS-03-Agbani produced significantly heavier weight than other accessions. There was a significant increase in plant weight as NPK levels increases up to 15t ha^{-1} PM + 300kg ha^{-1}NPK beyond which a deceased was recorded at all harvesting stages. Plants that received 15t ha^{-1} PM + 300kg ha^{-1} NPK produced significantly ($P<0.05$) higher fresh plant weight across the harvesting stages and in both years. Control had the least values (Tables 162 and 164). At 8 and 16 WAP in 2014 fresh plant weight were similar with the application of 15t ha^{-1} PM + 300kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} in ENS-01-Ikem and ENS-02-Orba which were significantly ($P<0.05$) higher than ENS-03-Agbani at the same application rates (Table 15).

In 2016 (Table 193) at 8 WAP, 15t ha^{-1} PM + 300kg ha^{-1} NPK gave significantly more weight in ENS-02-Orba and ENS-03-Agbani than ENS-01-Ikem at the same application rates. Furthermore, the application of 15t ha^{-1} PM + 200kg ha^{-1}NPK at 8, 12 and 16 WAP in 2014 at 8 WAP in 2016 produced significantly higher yield than at 15t ha^{-1} PM + 100kg ha^{-1} NPK and zero control across all accessions (Table 16).

Dry plant weight (g)

ENS-03-Agbani obtained significantly ($P<0.05$) higher dry plant weight at 8 and 12 WAP in both cropping seasons than what was obtained from other accessions. Furthermore, at 8 and 12 WAP, ENS-01-Ikem and ENS-02-Orba gave statistically comparable yield at 12 WAP in dry plant weight in 2014 and 8WAP in 2016. There was a significant increase in plant weight as NPK levels increases up to 15t ha^{-1} PM + 300kg ha^{-1} NPK beyond which a deceased was recorded at all harvesting stages. In 2014 and 2016 planting seasons, Plants that were treated with 15t ha^{-1}

PM h+ 300kg ha^{-1} NPK produced significantly (P<0.05) higher dry plant weight across the harvesting stages than other treatment combinations. Furthermore, at 8, 12 and 16 WAP, plants that were received 15t ha^{-1} PM + 400kg ha^{-1} NPK significantly (P<0.05) outweighed those treated with 15t ha^{-1} PM + 200kg ha^{-1} NPK and 15t ha^{-1} PM + 100kg ha^{-1} NPK. Control had the least values. In 2014, at 8 and 16 WAP dry plant weight and were similar at 15t ha^{-1} PM + 300kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} of NPK in ENS-01-Ikem and ENS-02-Orba which were significantly (P<0.05) higher than ENS-03-Agbani at the same application rates (Table 17).

In 2016, ENS-03-Agbani and ENS-02-Orba produced similar weight with the application of 15t ha^{-1} PM + 300kg ha^{-1} NPK and 15t ha^{-1} PM + 400kg ha^{-1} NPK and were significantly higher than ENS-01-Ikem at the same application rate and other treatment combinations. Furthermore, the application of 15t ha^{-1} PM + 200kg ha^{-1} NPK at 8, 12 and 16 WAP produced significantly higher yield than at 15t ha^{-1} PM + 100kg ha^{-1} NPK and zero control across all accessions in both planting seasons (Table 18).

Table 1: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on number of branches/plant of gongronema in 2014 and 2016 cropping seasons

	Number of Branches /plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC						
ENS-01-IKEM	11.63	9.87	13.80	12.13	15.92	14.27
ENS-02-ORBA	11.75	10.87	13.98	12.40	16.54	13.87
ENS-03-AGBANI	11.75	10.27	14.19	12.53	16.95	5.47
LSD (0.05%)	NS	NS	NS	NS	0.37	NS
NPK						
0tPM+0kgNPK	6.43	5.44	7.88	6.67	9.30	8.00
15tPM+100kgNPK	10.77	9.11	12.44	11.11	14.35	12.56
15tPM+200kgNPK	12.59	11.00	14.60	13.00	16.59	14.78
15tPM+300kgNPK	14.78	13.67	18.61	16.33	22.26	20.67
15tPM+400kgNPK	13.99	12.44	16.40	14.67	19.84	18.33
LSD (0.05%)	0.48	0.87	0.53	0.78	0.47	0.76
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	NS	NS

NS: Not significantly different

Table 2: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on number of leaves/plant of gongronema in 2014 and 2016 cropping seasons

	Number of leaves /plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	129.27	240.00	153.33	143.32	176.87	166.31
ENS-02-ORBA	130.53	122.73	155.33	150.00	183.73	152.00
ENS-03-AGBANI	130.63	128.40	157.53	273.00	188.33	176.31
LSD (0.05%)	NS	NS	NS	NS	4.08	NS
NPK						
0tPM0kgNPK	71.44	66.22	87.56	76.00	103.33	90.31
15tPM+100kgNPK	119.67	114.00	138.22	134.01	159.44	152.10
15tPM+200kgNPK	139.89	137.78	162.22	163.00	184.33	175.01
15tPM+300kgNPK	164.22	160.11	206.78	395.00	247.33	232.80
15tPM+400kgNPK	155.44	147.22	182.22	175.00	220.44	212.01
LSD (0.05%)	5.38	5.96	5.85	NS	5.27	6.91
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	NS	*

NS: Not significantly different *: significantly different

Table 3: Interaction effect of accessions and NPK rates plus optimum poultry manure rate on number of leaves/plant of gongronemma in 2016 cropping season

		Number of leaves /plant Harvesting periods
(Weeks)	**Treatments** 16	**Accessions (AC) PM+NPK**
ENS-01-IKEM	0tPM+0kgNPK	103.31
	15tPM+100kgNPK	141.70
	15tPM+200kgNPK	170.00
	5tPM+300kgNPK	211.31
	15tPM+400kgNPK	206.32
ENS-02-ORBA	0tPM+0kgNPK	84.07
	15tPM+100kgNPK	159.72
	15tPM+200kgNPK	177.00
	15tPM+300kgNPK	241.01
	15tPM+400kgNPK	212.71
ENS-03-AGBANI	0tPM+0kgNPK	83.00
	15tPM+100kgNPK	154.70
	15tPM+200kgNPK	179.71
	15tPM+300kgNPK	246.00
	15tPM+400kgNPK	218.31
LSD		11.98

Table 4: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on fresh leaves weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Fresh leaves weight (g)/plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	78.85	74.27	93.53	89.29	107.89	103.08
ENS-02-ORBA	79.63	73.37	94.75	88.88	112.08	106.03
ENS-03-AGBANI	79.67	73.78	96.10	92.16	114.88	110.25
LSD (0.05%)	NS	NS	NS	NS	2.49	NS
NPK						
0tPM+0kgNPK	43.58	39.72	53.41	49.34	63.03	58.64
15tPM+100kgNPK	73.00	69.26	84.32	81.17	97.26	91.18
15tPM+200kgNPK	85.33	81.06	98.96	94.04	112.44	107.61
15tPM+300kgNPK	100.18	93.06	126.13	121.77	150.87	145.14
15tPM+400kgNPK	94.82	85.06	111.16	104.23	134.47	129.63
LSD (0.05%)	3.28	3.80	3.57	5.22	3.21	4.30
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	NS	NS

NS: Not significantly different

Table 5: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on dry leaves weight (g) /plant of gongronema in 2014 and 2016 cropping seasons

	Dry leaves weight (g)/plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	18.14	14.82	21.51	19.46	24.81	3.33
ENS-02-ORBA	18.31	15.97	21.79	20.48	25.78	3.87
ENS-03-AGBANI	18.32	16.44	22.10	20.14	26.42	4.34
LSD (0.05%)	NS	NS	NS	NS	0.57	NS
NPK						
0tPM+0kgNPK	10.02	8.42	12.28	10.46	14.50	12.45
15tPM+100kgNPK	16.79	12.85	19.39	17.51	22.37	20.31
15tPM+200kgNPK	19.63	17.09	22.76	20.75	25.96	24.03
15tPM+300kgNPK	23.04	21.02	29.01	27.59	34.70	32.84
15tPM+400kgNPK	21.81	19.43	25.57	23.98	30.93	29.60
LSD (0.05%)	0.75	1.10	0.82	0.55	0.74	0.98
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	NS	NS

NS: Not significantly different

Table 6: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on vine length (m)/plant of gongronema in 2014 and 2016 cropping seasons

	Vine length(m) /plant					
	Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	1.68	1.64	2.53	2.48	3.25	3.21
ENS-02-ORBA	1.97	1.84	2.94	2.89	3.39	3.33
ENS-03-AGBANI	2.18	2.12	2.77	2.73	3.32	3.27
LSD (0.05%)	0.18	0.14	0.12	0.17	NS	NS
NPK						
0tPM+0kgNPK	1.04	0.81	1.24	1.91	1.50	1.47
15tPM+100kgNPK	1.57	1.49	2.49	2.45	3.25	3.21
15tPM+200kgNPK	1.90	1.84	3.00	2.95	3.73	3.69
15tPM+300kgNPK	2.75	2.30	3.63	3.58	4.12	4.06
15tPM+400kgNPK	2.46	2.41	3.36	3.32	4.12	3.93
LSD (0.05%)	0.23	0.18	0.21	0.22	0.16	0.16
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	NS	NS

NS: Not significantly different

Table 7: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on fresh vine weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Fresh vine weight (g)/plant					
	Harvesting periods (Weeks)					
	8		2		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	77.93	74.53	97.32	94.20	128.16	123.20
ENS-02-ORBA	79.26	76.33	101.59	98.47	126.00	122.73
ENS-03-AGBANI	84.92	78.33	107.00	103.20	126.62	23.20
LSD (0.05%)	2.54	NS	3.09	2.96	NS	NS
PM+NPK						
0tPM+0kgNPK	53.92	49.78	60.63	57.76	63.11	60.33
15tPM+100kgNPK	69.90	66.22	79.51	76.33	98.08	92.89
15tPM+200kgNPK	84.89	81.44	103.37	99.33	140.82	36.33
15tPM+300kgNPK	100.03	95.00	138.29	134.34	169.62	66.33
15tPM+400kgNPK	94.72	89.56	128.04	125.36	163.01	59.54
LSD (0.05%)	3.28	2.94	3.99	3.82	4.57	4.46
AC X PM+NPK interaction						
LSD (0.05%)	NS	NS	*	*	NS	NS

NS: Not significantly different *: significantly different

Table 8: Interaction effect of accessions and NPK rates plus optimum poultry manure rate on fresh vine weight (g)/plant of gongronemma in 2014 and 2016 cropping seasons

		Fresh vine weight (g) /plant	
		Harvesting periods (12 Weeks)	
Treatments		2014	2016
Accessions (AC)	PM+NPK		
ENS-01-IKEM	0tPM+0kgNPK	60.96	58.00
	15tPM+100kgNPK	76.01	73.00
	15tPM+200kgNPK	91.01	88.00
	15tPM+300kgNPK	136.28	131.00
	15tPM+400kgNPK	121.72	121.00
ENS-02-ORBA	0tPM+0kgNPK	61.29	58.62
	15tPM+100kgNPK	80.16	77.33
	15tPM+200kgNPK	97.08	92.00
	15tPM+300kgNPK	8.36	136.33
	15tPM+400kgNPK	131.05	128.00
ENS-03-AGBANI	0tPM+0kgNPK	59.65	55.67
	15tPM+100kgNPK	81.77	78.67
	15tPM+200kgNPK	122.01	118.00
	15tPM+300kgNPK	140.22	135.67
	15tPM+400kgNPK	131.35	128.01
LSD (0.05)		6.91	6.61

Table 9: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on dry vine weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Dry vine weight (g)/plant					
	Harvesting periods (Weeks)					
	8		12		16	
Treatments	2014	2016	2014	2016	2014	2016
Accessions (AC)						
ENS-01-IKEM	20.26	17.93	25.30	23.73	33.32	30.87
ENS-02-ORBA	20.61	18.47	26.41	23.73	32.76	30.40
ENS-03-AGBANI	22.08	19.80	27.82	25.47	32.92	30.60
LSD (0.05%)	0.66	0.90	0.80	NS	NS	NS
NPK						
0tPM+0kgNPK	14.03	12.00	15.76	13.56	16.41	14.11
15tPM+100kgNPK	18.17	16.00	20.67	18.11	25.50	23.22
15tPM+200kgNPK	22.07	19.89	26.88	25.67	36.61	33.67
15tPM+300kgNPK	26.01	23.89	35.95	33.44	44.10	41.78

15tPM+400kgNPK	24.63	21.89	33.29	30.78	42.38	40.33
LSD (0.05%)	0.85	1.17	1.04	1.60	1.19	0.71
AC X NPK interaction						
LSD (0.05%)	NS	NS	*	NS	NS	NS

NS: Not significantly different *: significantly different

Table 10: Interaction effect of accessions and NPK rates plus optimum poultry manure rate on dry vine weight (g)/plant of gongronemma in 2014 cropping season

Treatments		Dry vine weight (g) /plant Harvesting periods (12 Weeks)
Accessions (AC)	**PM+NPK**	
ENS-01-IKEM	0tPM+0kgNPK	15.85
	15tPM+100kgNPK	19.22
	15tPM+200kgNPK	23.06
	15tPM+300kgNPK	35.43
	15tPM+400kgNPK	31.65
ENS-02-ORBA	0tPM+0kgNPK	15.94
	15tPM+100kgNPK	20.84
	15tPM+200kgNPK	25.24
	15tPM+300kgNPK	35.97
	15tPM+400kgNPK	34.07
ENS-03-AGBANI	0tPM+0kgNPK	14.51
	15tPM+100kgNPK	21.26
	15tPM+200kgNPK	31.72
	15tPM+300kgNPK	36.46
	15tPM+400kgNPK	34.15
LSD (0.05)		1.80

Table 11: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on root length (m)/plant of gongronema in 2014 and 2016 cropping seasons

	Root length (m)/plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	0.19	0.16	0.26	0.24	0.36	0.34
ENS-02-ORBA	0.19	0.17	0.29	0.27	0.37	0.34
ENS-03-AGBANI	0.19	0.18	0.31	0.29	0.39	0.37
LSD (0.05%)	NS	NS	0.02	NS	0.02	NS
NPK						
0tPM+0kgNPK	0.09	0.07	0.12	0.11	0.14	0.12
15tPM+100kgNPK	0.16	0.15	0.25	0.22	0.33	0.32
15tPM+200kgNPK	0.21	0.19	0.31	0.28	0.40	0.39
15tPM+300kgNPK	0.26	0.24	0.40	0.38	0.52	0.49
15tPM+400kgNPK	0.24	0.21	0.37	0.37	0.48	0.45
LSD (0.05%)	0.02	0.02	0.02	0.03	0.02	0.02
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	NS	NS

NS: Not significantly different

Table 12: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on fresh root weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Fresh root weight (g)/plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	11.18	9.68	15.43	14.54	18.24	7.08
ENS-02-ORBA	11.75	10.63	15.37	14.76	18.68	7.58
ENS-03-AGBANI	11.59	10.82	16.54	15.62	20.45	9.45
LSD (0.05%)	NS	NS	0.56	NS	0.42	0.61
NPK						
0tPM+0kgNPK	7.58	6.92	8.81	8.23	9.82	9.30
15tPM+100kgNPK	10.15	9.04	12.14	11.99	15.99	15.09
15tPM+200kgNPK	12.67	11.41	16.90	16.16	20.46	19.01
15tPM+300kgNPK	13.54	12.19	21.05	19.81	26.12	24.85
15tPM+400kgNPK	13.60	12.33	19.99	18.68	23.24	21.93
LSD (0.05%)	0.52	0.84	0.72	1.06	0.54	0.79
AC X NPK interaction						
LSD (0.05%)	NS	NS	NS	NS	*	*

NS: Not significantly different *: significantly different

Table 13: Interaction effect of accessions and NPK rates plus optimum poultry manure rate on fresh root weight (g)/plant of gongronemma in 2014 and 2016 cropping seasons

Fresh root weight (g)/plant			
		Harvesting periods (Weeks)	
		16	
Treatments		2014	2016
Accessions (AC)	NPK levels		
ENS-01-IKEM	0tPM+0kgNPK	9.68	9.12
	15tPM+100kgNPK	14.87	13.92
	15tPM+200kgNPK	18.27	16.70
	15tPM+300kgNPK	25.48	24.71
	15tPM+400kgNPK	22.93	21.48
ENS-02-ORBA	0tPM+0kgNPK	9.71	9.30
	15tPM+100kgNPK	15.45	14.48
	15tPM+200kgNPK	20.70	19.32
	15tPM+300kgNPK	25.86	24.66
	15tPM+400kgNPK	21.70	20.16
ENS-03-AGBANI	0tPM+0kgNPK	10.08	9.48
	15tPM+100kgNPK	17.64	16.88
	15tPM+200kgNPK	22.04	21.01
	15tPM+300kgNPK	27.04	25.71
	15tPM+400kgNPK	25.10	24.16
LSD (0/05)		0.94	1.37

Table 14: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on dry root weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Dry root weight (g)/plant					
	Harvesting periods (Weeks)					
	8		12		16	
Treatments	2014	2016	2014	2016	2014	2016
Accessions (AC)						
ENS-01-IKEM	2.92	2.65	4.19	4.00	4.26	4.02
ENS-02-ORBA	2.81	2.54	3.83	3.53	3.92	3.65
ENS-03-AGBANI	2.68	2.50	3.77	3.56	3.77	3.58
LSD (0.05%)	NS	NS	0.21	0.20	0.21	NS
NPK						
0tPM+0kgNPK	1.84	1.64	2.17	1.99	2.17	2.03
15tPM+100kgNPK	2.16	1.97	2.70	2.47	2.70	2.43
15tPM+200kgNPK	2.84	2.50	3.91	3.66	3.91	3.68
15tPM+300kgNPK	3.65	3.35	5.40	5.14	5.70	5.38
15tPM+400kgNPK	3.52	3.27	5.46	5.23	5.44	5.24

LSD (0.05%)	0.21	0.24	0.27	0.26	0.27	0.30
AC X NPK interaction						
LSD (0.05)	NS	NS	NS	NS	NS	NS

NS: Not significantly different

Table 15: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on fresh plant weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Fresh plant weight (g)/plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	55.99	53.69	84.76	82.34	68.76	65.33
ENS-02-ORBA	56.88	54.58	85.59	82.67	70.57	67.21
ENS-03-AGBANI	58.73	52.50	87.32	84.47	73.21	69.48
LSD (0.05%)	1.02	1.14	1.20	NS	1.33	1.74
NPK						
0tPM+0kgNPK	35.04	32.53	45.32	42.44	40.95	37.52
15tPM+100kgNPK	51.02	49.27	70.44	67.87	58.66	54.52
15tPM+200kgNPK	60.97	58.70	91.24	88.40	73.07	69.66
15tPM+300kgNPK	71.25	68.76	115.54	122.92	95.16	91.93
15tPM+400kgNPK	67.71	65.37	106.91	104.07	86.40	88.58
LSD (0.05%)	1.31	1.47	1.55	2.16	1.72	2.25
AC X NPK interaction						
LSD(0.05)	*	*	*	NS	*	NS

NS: Not significantly different *: significantly different

Table 16: Interaction effect of accessions and NPK rates plus optimum poultry manure rate on fresh plant weight (g)/plant of gongronemma Fresh plant weight (g)/plant

		Harvesting periods (Weeks)			
	8	12		16	
Treatments		**2014**	**2016**	**2014**	**2016**
Accessions (AC)	**NPK levels**				
ENS-01-IKEM	0tPM+0kgNPK	36.41	34.00	41.70	47.20
	15tPM+100kgNPK	48.99	47.07	56.86	69.93
	15tPM+200kgNPK	60.02	56.90	67.69	87.31
	15tPM+300kgNPK	70.89	62.08	93.26	114.57
	15tPM+400kgNPK	63.57	62.18	84.29	104.81
ENS-02-ORBA	0tPM+0kgNPK	33.21	30.55	39.95	44.07
	15tPM+100kgNPK	50.44	48.88	59.27	71.97
	15tPM+200kgNPK	62.47	60.90	70.76	91.80
	15tPM+300kgNPK	70.99	68.24	96.01	114.70
	15tPM+400kgNPK	67.27	64.35	86.87	105.53

ENS-03-AGBANI	0tPM+0kgNPK	35.51	32.80	41.21	44.70
	15tPM+100kgNPK	53.61	51.87	59.83	69.43
	15tPM+200kgNPK	60.35	58.31	80.78	94.60
	15tPM+300kgNPK	71.86	69.95	96.20	117.34
	15tPM+400kgNPK	72.30	69.57	88.02	110.53
LSD (0.05%)		2.27	2.54	2.97	2.68

Table 17: The effect of accessions, NPK rates plus optimum poultry manure rate and their interactions on dry plant weight(g)/plant of gongronema in 2014 and 2016 cropping seasons

	Dry plant weight (g)/plant Harvesting periods (Weeks)					
	8		12		16	
Treatments	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
Accessions (AC)						
ENS-01-IKEM	13.77	12.28	17.00	15.44	20.80	18.49
ENS-02-ORBA	13.91	12.59	17.35	16.05	20.82	18.73
ENS-03-AGBANI	14.36	13.37	17.90	16.76	21.04	19.20
LSD (0.05%)	0.22	0.35	0.32	0.60	NS	NS
NPK						
0tPM+0kgNPK	8.63	7.27	10.07	8.95	11.03	8.79
15tPM+100kgNPK	12.37	10.97	14.25	12.92	16.86	15.72
15tPM+200kgNPK	14.85	13.80	17.85	16.35	22.13	19.56
15tPM+300kgNPK	17.57	16.39	23.46	22.03	28.16	25.80
15tPM+400kgNPK	16.65	15.32	21.44	20.17	26.25	23.49
LSD (0.05%)	0.29	0.45	0.42	0.77	0.40	1.37
AC X NPK interaction						
LSD(0.05)	*	*	*	NS	*	NS

NS: Not significantly different *: significantly different

Table 18: Interaction effect of accessions and NPK rates plus optimum poultry manure rate on dry plant weight (g)/plant of gongronemma

Dry plant weight (g)/plant Harvesting periods (Weeks)					
		8	12	16	
Treatments		**2014**	**2016**	**2014**	**2016**
Accessions (AC)	**NPK levels**				
ENS-01-IKEM	0tPM+0kgNPK	9.01	7.01	10.29	11.52
	15tPM+100kgNPK	11.97	10.36	13.92	16.92
	15tPM+200kgNPK	14.66	13.53	16.70	21.50
	15tPM+300kgNPK	17.45	15.71	23.12	28.19
	15tPM+400kgNPK	15.75	14.28	20.98	25.96

ENS-02-ORBA	0tPM+0kgNPK	8.13	7.28	9.89	10.78
	15tPM+100kgNPK	12.26	10.66	14.35	17.27
	15tPM+200kgNPK	15.23	13.82	17.27	22.26
	15tPM+300kgNPK	17.50	16.50	23.64	27.88
	15tPM+400kgNPK	16.42	14.75	21.58	25.92
ENS-03-AGBANI	0tPM+0kgNPK	8.76	7.03	10.05	10.78
	15tPM+100kgNPK	12.89	11.88	14.50	16.38
	15tPM+200kgNPK	14.65	14.03	19.58	22.63
	15tPM+300kgNPK	17.75	16.96	23.60	28.42
	15tPM+400kgNPK	17.76	16.93	21.76	26.97
LSD (0.05%)		0.50	0.78	0.73	0.69

Discussion

In this study, results indicated a progressive increased in number of branches and leaves, length of roots and vine, fresh and dry leaves, vine root and plant of gongronema plant with optimum 15t ha^{-1} of poultry manure and increasing rates of inorganic fertilizer (NPK 15-15-15) up to 300 kg ha^{-1} in both cropping seasons. The highest increase was at 12 and 16 weeks after planting (WAP) and the least was obtained in the control. This was in conformity with the finding of Olowoake (2014) on vegetable. Akanni *et al* (2011) posited that increasing the rates of organomineral fertilizer increase plant height of maize. Law-ogbmo and Ajayi (2009) also reported that foliage yield of amaranthus increased with increase in organomineral application rate.

Gongronema plant produced the highest number of branches at 15t ha^{-1} of poultry manure + 300 kg ha^{-1} of NPK as compared to the other treatment combinations. This may be due to synergistic effect of combining organic and inorganic fertilizer which supplied needed plant nutrient. Also, the rapid performance on growth characteristic may be due to rapid release of nutrient from inorganic fertilizer for initial growth stage while poultry manure provided the needed nutrient at the later growth stage. Adeoye *et al.* (2014) in their finding stated that the combined application of optimum level of poultry manure and reduced level of inorganic fertilizer is suitable for vegetable production. Olowoake (2013) also demonstrate the application of reduced organic manure rate in combination of mineral fertilizer enhanced general growth and yield of maize. Adeoowa and Adegun (2014) reported increase in amaranthus branches and number of leaves with use of optimum poultry manure rate in combination with reduced level of NPK.

The application of 15t ha^{-1} of poultry manure + 300 kg ha^{-1} of NPK produced the highest fresh and dry leaves, vine, root and plant weight $plant^{-1}$ across WAP. Increasing rates of nitrogen as a result of increased of NPK fertilizer affected the fresh and dry matter weight beacuase nitrogen stimulates vegetative growth, increase meristimatic and physiology activities in plant, increase number of leaves; as a result of increments in number of leaves, increases the rate of photosynthesis and thus, higher dry matter production. This is in line with different studies conducted by Akanbi *et al.* (2015) on okra and Ayeni (2018) on tomotoes.

There was general reduction in foliage yield of gongronema with the application of 15t ha^{-1} of poultry manure + 400 kg ha^{-1} of NPK. This could be due to increase in soil acidity as a result of increase in inorganic fertilizer. This finding is in agreement with Zeliag *et al* (2015). They associated reduction in vegetable crop yield as result of increase in soil acidity and nutrient inbalance with continues increase of inorganic fertilizer (NPK).

There were no significant differences between 15t ha^{-1} of poultry manure + 300 kg ha^{-1} of NPK and 15t ha^{-1} of poultry manure + 400 kg ha^{-1} of NPK on vine length and fresh root weight of gongronema plant in this study. This could be due to luxury consumption of nitrogen and the production of vegetative growth at the expense of high vine length and root growth at 15t ha^{-1} of poultry manure + 400 kg ha^{-1} of NPK. This finding is in agreement with the result of Adeoye *et al* (2012) which reported luxury consumption of nitrogen at the expense of high grain yield in maize with the application of 18t ha^{-1} of poultry manure.

Interaction effect of accessions and combined optimum poultry manure rate + different rates of NPK were significant on gongronema fresh and dry vine weight at 12 WAP, fresh and dry root weight at 16 WAP and fresh and dry plant weight at 8, 12 and 16 WAP. It was observed the highest yield was achieved with ENS-03-Agbani followed by ENS-02-Orba and then ENS-01-Ikem at 15t ha^{-1}of poultry manure + 400 kg ha^{-1} of NPK and significantly outweighs those from other treatment combinations. The differences in genetic makeup accessions, amount of nutrient applied and utilization potential could be responsible for the observed differences in this study. The finding is also in consonance with that of Hag et al (2010) they reported increased in grain and foliage yield of rice as the rates of NPK increases.

In this study, it was observed that ENS-03-Agbani produced the highest mean values of number of branches and leaves, length of vine and root, fresh and dry leaves, vine and plant plant^{-1} which were succeeded by ENS-02-orba and then ENS-01-Ikem at 8, 12 and 16 WAP.

Conclusion

The study showed that the use of combined poultry manure and NPK fertilizer had better effect on growth and yield of gongronema. Also, a combination of 15t ha^{-1} + 300kg ha^{-1} of NPK fertilizer perform the best among the combination of treatment applied and the accession ENS-03-Abgani is hereby recommended for cultivation by the farmers in the experimental area.

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