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Influence of Single and Compound Based Fertilizers on Army Worm Incidence, DNA Concentrations and Performance of Selected Maize (*Zea mays* L) Genotypes

Israel P. Eno¹ and Godwin M. Ubi²¹Department of Crop Science, Akwa Ibom State University, Nigeria²Department of Genetics and Biotechnology, University of Calabar, Nigeria*Corresponding Author: Email: israel_eno@yahoo.com; israelgotvictory2013@gmail.com

Abstract

A study was conducted between the months of April to August 2019 to ascertain the DNA concentration, incidence of army worm, growth and yield performance of selected maize genotypes to single and compound based fertilizers in Calabar, Nigeria. Three maize genotypes namely Oba super 6, hybrid yellow maize and the local white maize; three fertilizer types including single (urea) and compound fertilizers (NPK) were used for the study. The experiment was laid out in the field adopting the Randomized Complete Block design (RCBD). The results showed that all the maize genotypes used for the experiment performed significantly well in terms of the growth and yield traits evaluated. The concentration of the total genomic DNA in the maize genotypes varied significantly with the hybrid yellow maize genotype having the highest concentration of total genomic DNA of 76.9 ng/ul compared to the local white maize genotype which had the least concentrations of total genomic DNA of 34.4 ng/ul. Hence in the hierarchy in genomic DNA concentrations was: hybrid yellow maize > Oba super 6 > local white maize genotype. Similarly, in terms of the growth attributes evaluated for which were plant height, internode length, leaf length, leaf width, leaf area and number of leaves per plant, hybrid yellow maize > Oba Super 6 > local white maize while urea > NPK > Single Super Phosphate (SSP). For the yield attributes, hybrid yellow maize > Oba Super 6 > local white maize while SSP > NPK > Urea in terms of fruit yield. The results further showed that all the treatments differed significantly from the control ($P < 0.05$) with compound fertilizer significantly reducing the number of holes (incidence) counted on the leaves and stems of army worm compared to single fertilizers. The results revealed that the maize varieties were more influenced by adequate single fertilizer application in terms of the growth and fruit yield. Also for the consumption of superior quality maize genotype, the hybrid yellow maize with high genomic DNA should be used as breeding stock for increased and improved yield and quality of maize crop as well as ensuring food security for the nation.

Keywords: *Busseola fusca*, Total genomic DNA, Growth and Yield Attributes, Single and Compound Fertilizers, *Zea mays*

1. Introduction

Maize (*Zea mays L.*), commonly known as corn (in most parts of the world) originated in Central Mexico around 5,000 BC. It ranks third after wheat and rice in the world food grain production (Adu, 1995). It is grown extensively with equal success in temperate, sub- tropical and tropical regions of the world. Maize is grown both (as sweet corn) for human consumption and (as field corn) for other uses such as animal feed and biofuels. In addition to meeting the food requirement of human and livestock, maize is put to many industrial uses.

It is a well-known fact that the yield potential of a crop is mainly dependent on its genetic make-up as well as the environment which it is grown (Amerson, 1992). The genetic potential however, can be exploited to the maximum by providing a favourable growth environment. The climatic conditions and existing varieties in our country are highly favourable for increasing the production of maize.

Fertilizer plays an important role in increasing the maize yield (they contribute 40-45%); balanced and ultimate use of single and compound based fertilizer play a vital role in increasing the yields of cereals (Bectroa, 1990). Though the yield potential of our present varieties is high enough, they have not been explored fully due to some production constraints, such as proper level and ration of fertilizer importance.

Production of maize is however threatened by insect pest such as Army worms (Lepidoptera: Noctuidae), *Busseola fusca* ((CGIAR,1996) and *Mussidia nigrivennella* (Setamou *et al.*, 2000). This insect is a common pest in many African countries including Nigeria. Damage is caused by the caterpillars, which first feed on the young leaves and later enter into the stems, killing the growing points of the plant and causing dead- heart that disrupts the flow of nutrients to the grain (Pascal, 1998). Infested young plants show small holes and ‘window- panes in the leaf whorls where tissue have been eaten. Symptoms in maize plants include dead-heart, internal feeding and presence of frass in the stems (Setamou *et al.*, 2000). Older caterpillars tunnel into the stems, and eat up long frass-filled galleries, which weaken the stems and cause breakage (Pascal,1998). Yield reductions occur every year due to insect pest feeding, or stalk lodging. The potential yield of maize within an environment could be realized when pests are managed by scouting field regularly and applying treatments when necessary.

Grain damaged by the high incidence of army worm become susceptible to secondary infection by moulds such as *Aspergillus flavus* which produce aflatoxin, a toxic by- product that is extremely poisonous to humans which can lead to cancer (Setamou *et al.*, 2000). Maize stem borers are difficult to control with insecticides (Vitale *et al.*, 2007) because the current spray-based methods have been found to be ineffective against the internal feeders in addition to being costly and hazardous (Clive, 2003).

Therefore, the study of fertilizer application on the army worm incidence on maize would be useful to determine their effect on maize growth and yield potentials (Addiscot, 1987). Hence, this study was designed to compare the effect of single and compound based fertilizers on the army worm incidence, total genomic DNA, and the growth/yield of maize (*Zea mays*) genotypes in the rain forest ecology of Nigeria.

2. Materials and Methods

2.1 Experimental Site

The research study was carried out at the research farm of the Department of Genetics and Biotechnology University of Calabar, Calabar in the 2019 planting season.

2.2 Source of Experimental Materials

Maize varieties used for this research was sourced and obtained from the Agricultural Development Programme office in Calabar (CRADP). The maize varieties included: Oba super 6, hybrid yellow maize and Local white maize. Simple and compound based fertilizers was also sourced and purchased from the CRADP office in Calabar. Simple base fertilizers used for the study included: Urea, simple super phosphate. While compound fertilizers used for the study included: N.P.K 15:15:15

The single and compound fertilizers were applied at the rate 250 kg/ha, an equivalent of 5 bags/ha. The land used for the study measured 10 x 4m to give a total area of 40 m². The fertilizer rate equivalent to the land used was extrapolated and used for the study. Fertilizer rate was calculated as follows:

1 bag of fertilizer = 50kg

1 hectare of land = 10,000 m²

Size of land used = 10 x 4 m = 40 m²

10,000 m² of farm land required 250 kg of fertilizer

40 m² of farmland = $250\text{kg} \times 40\text{ m}^2 / 10,000\text{ m}^2 = 1.0\text{ kg}$

For 5 bags, 40 m² will require $1/5 = 0.2\text{kg}$ of each fertilizer

Fertilizer rate = $50\text{ kg} \times 40\text{m}^2/10000\text{m}^2 = 0.2\text{ kg}$ of each fertilizer.

2.4 Data Collection

Data for the study was collected for growth and yield attributes. Growth attributes included: Plant height, number of leaves per plant, internode length, leaf length, leaf width, Leaf area. Yield attributes included: Days to 50% flowering, days to physiological maturity, no of cobs per plants, no of seeds per cob and fresh cob weight. The leaf area was determined by measuring the length (cm) and width (cm) of leaves and multiplying the results by the Keplers constant of 0.74.

2.3 Experimental Design and Layout

Table 2.1: Field experiment layout.

Rep I	Rep II	Rep III
A ₁ B ₁	A ₁ B ₃	A ₁ B ₃
A ₁ B ₂	A ₁ B ₂	A ₃ b ₃
A ₁ B ₃	A ₃ B ₃	A ₁ B ₂
A ₂ B ₂	A ₁ B ₁	A ₂ B ₂
A ₂ B ₂	A ₁ B ₂	A ₃ B ₃
A ₂ B ₂	A ₁ B ₂	A ₃ B ₂
A ₃ B ₁	A ₂ B ₂	A ₂ B ₁
A ₃ B ₂	A ₃ B ₁	A ₃ B ₁
A ₃ B ₃	A ₃ B ₂	A ₁ B ₁

Key: A₁ = Oba super 6 maize variety; A₂ = hybrid yellow maize; A₃ = Sweet white corn; B₁ = Urea fertilizer; B₂ = Single super phosphate; B₃ = NPK fertilizers. The experimental design was a 3 x 3 factorial experiment with 3 replicates in a randomized complete block design (RCBD)

2.5 Determination of Army Worm Incidence on Maize

Army worm incidence was determined by calculating the incidence/field as follows;

$$\text{Incidence per field(\%)} = \text{No of plant infected} \div \text{total no of plants examined} \times 100$$

2.6 Determination of Total Genomic DNA in Maize

The leaf materials from all the maize genotypes was collected for genomic DNA extraction at two weeks of age and after the application of equal amounts of single and compound fertilizers. The total genomic DNA for the template was isolated from the leaves of maize plants following a modified CTAB method. DNA samples were extracted from the leaves by removing a leaf disc of each cultivar using the lid of a 1.5 ml microfuge tube and flash frozen in liquid nitrogen (-196 °C). The frozen leaf tissues were then quickly grounded to a fine powder using a micropestle followed by addition of 1-2 µl of RNase from stock solution (10 mg ml⁻¹) to 1ml of extraction buffer. Before thawing the samples, 600 µl aliquot of the extraction buffer was added to each of the tissue samples. The samples were vortexed on a vortex mixer for three seconds and incubated in a water bath at 45 °C for 15 minutes.

Samples were then centrifuged for 2 minutes at 13000 revolutions per minute. 500 µl of the supernatant was drawn using a micropipette (1 ml) and transferred to a new microfuge tube and 500 µl of ice cold isopropanol was added to the supernatant. The original microfuge tube containing the leaf tissue was discarded. The supernatant was subsequently incubated in ice for 5 minutes and centrifuged for 5 minutes. After centrifuging, the supernatants were discarded and 600 µl of ethanol (70% v/v) was added and centrifuged again for 3 minutes. The supernatants were

discarded leaving behind pellets which was air-dried in a laminar airflow bench. The pellets were later re-suspended for 15-20 minutes in 50 µl of DNase free water.

2.5 DNA Quantification

The extracted genomic DNA was quantified using the Nanodrop 1000 spectrophotometer. The equipment was initialized with 2 µl of sterile distilled water and blanked using normal saline solution. 2 µl of the extracted DNA was loaded into the lower pedestal, the upper pedestal was brought down to contact the extracted DNA on the lower pedestal. The DNA concentration was measured by clicking on the “measure” button.

2.6 Determination of Soil Physical and Chemical Properties

Soil samples from the experimental site were sampled using a soil auger to a depth of 0-40 cm. The soil samples were bulked differently, air dried, crushed, sieved to pass through 2 mm mesh and analyzed for physico-chemical properties using standard laboratory procedures in soil science as follows:

- (a) Soil particle size distribution for percentage silt, clay and sand was measured using the hydrometer method of Bouyoucos, (1975).
- (b) Soil pH at 1:2.5 soil to water ratio was determined using electrode pH meter.
- (c) Organic carbon was determined using the methods of Walkey & Black (1934).
- (d) Total nitrogen was determined using the procedures of Jackson, (1965).
- (e) Exchangeable Acidity was determined using the procedures of Mclean, (1965).
- (f) Exchangeable Bases Mg, K and Na were determined using flame photometry while Ca was determined by the Atomic Absorption Spectrophotometry.
- (g) Available phosphorus was determined using the procedures of Bray & Kurtz, (1945).
- (h) Effective cation exchange capacity (ECEC) was obtained by cations summation method.

2.8 Data Analysis

Data generated from the study was analyzed using a two way analysis of variance (ANOVA) for a 3 x 3 factorial experiment in a randomized complete block design with three replicates. Significant differences between treatment means was separated using fishers least significant difference (LSD) test at 5% probability.

3. Results

3.1 Result of the Extracted Genomic DNA Quantification using Nanodrop spectrophotometer

The extracted genomic DNA after quantification using Nanodrop spectrophotometer revealed significant ($P < 0.05$) differences in the total genomic DNA concentrations in the selected maize genotypes as influenced by the applications of single and compound fertilizers (Table 3.2).

Table 3.1 Physico-chemical properties of the soil used in the experiment

Soil properties	Values
pH (H ₂ O)	5.3
Organic C (%)	6.12
Total N (%)	0.08
Available P (mg/kg-1)	6.15
Exchangeable bases (cmol kg ⁻¹)	0.79
Ca (mg/kg)	0.42
Mg (mg/kg)	0.13
K (mg/kg)	0.16
Na (mg/kg)	0.08
Exchangeable acidity	0.25
CEC (cmol kg ⁻¹)	0.12
Base saturation (%)	68.0
Sand (%)	65.0
Silt (%)	23.2
Clay (%)	14.5
Textural class	Sandy loam

The maize genotypes treated with compound fertilizer (NPK) showed higher genomic DNA compared with the maize genotypes treated with single fertilizers such as urea and single super phosphate (SSP). The results of genomic DNA quantification using the Nanodrop spectrophotometer revealed that the hybrid yellow maize (carotene based or vitamin A fortified maize) treated with NPK compound fertilizer accounted for the highest genomic DNA concentration of 76.9 ng/ul (Table 3.2). This was followed by same genotype of hybrid yellow maize treated with urea fertilizer which had 76.8 ng/ul genomic DNA concentration while same genotype treated with single super phosphate produced a genomic DNA of 76.7 ng/ul. The result in Table 3.2 also showed application of compound fertilizer (NPK) to Oba Super 6 maize genotypes also produced the highest genomic DNA concentration 72.9 ng/ul . Oba Super 6 maize genotype treated with single urea fertilizer showed a genomic DNA concentration of 72.8 ng/ul while same genotype treated with single super phosphate (SSP) fertilizer produced 72.7 ng/ul. The least genomic DNA concentrations in the maize genotypes was obtained from the local white maize treated with single and compound fertilizers producing total genomic concentrations of 34.6, 34.4 and 34.7 ng/ul respectively for urea, single super phosphate and NPK fertilizer treatments respectively.

Table 3.2: Influence of single and compound fertilizer on total genomic DNA concentrations in selected maize genotypes

Maize variety	Fertilizer type	DNA concentrations (ng/ul)
Oba Super 6	Urea	72.80
	SSP	72.70
	NPK	72.90
Hybrid yellow maize	Urea	76.70
	SSP	76.60
	NPK	76.80
Local white maize	Urea	34.60
	SSP	34.40
	NPK	34.70

ng/ul = Nanogram/Microliter

3.2 Growth Performance of Maize (*Zea mays* L) Genotypes as Influenced by Single and Compound Fertilizer Application

Table 3.3 presents results on the growth performance of three maize genotypes grown on soils treated with single and compound based fertilizers of urea, single super phosphate and NPK. The results as presented indicates that the growth attributes of the maize genotypes were significantly influenced by the applications of the single and compound based fertilizers. Significant ($p < 0.05$) differences and interaction exists among the maize genotypes evaluated and among the different fertilizers as well. The growth attributes evaluated for the maize genotypes included plant height (cm), number of leaves per plant, leaf length (cm), internode length (cm), leaf width (cm), and leaf area (cm²). The plant height measured from the maize genotypes ranged from 99.5 cm in local white maize treated with single super phosphate to as high as 168 cm in hybrid yellow maize treated with urea single based fertilizer only. The number of leaves per plant counted from the study varies from 8 in the local white maize treated with single super phosphate fertilizer to 16.3 leaves per plant in hybrid yellow maize treated with urea single based fertilizer. Shorter internode length of 6 cm was measured from local white maize treated with single super phosphate fertilizers while longer internode length measuring 9.7 cm was measured from hybrid yellow maize treated with urea single based fertilizers.

The results presented in Table 3.3 also shows that smaller leaf width of 5.27 cm was measured from the local white maize treated with NPK compound fertilizer while wider leaves measuring 12.45 cm was obtained from hybrid yellow maize leaves treated with urea single based fertilizer.

Similar trend was obtained with the leaf length. The shortest leaves measuring 34.98 cm on average was observed among the local white maize genotypes treated with single super phosphate while the longest leaves measured 74.13 cm among the hybrid yellow maize treated with urea. In a similar pattern the largest leaf area measuring 922.92 cm² was obtained from hybrid yellow maize genotype treated with urea while the smallest size leaves averaging 207.90 cm² were estimated from the local white maize treated with single super phosphate fertilizer.

3.3 Yield Performance of Maize (*Zea mays* L) Genotypes as Influenced by the Application of Single and Compound Based Fertilizers

Table 3.4 presents results on the yield performance of three maize genotypes grown on soils treated with single and compound based fertilizers of urea, single super phosphate and nitrogen, phosphorus and potassium (NPK) as compound fertilizer. The results indicated that only few of the yield components evaluated in the maize genotypes were significantly influenced by the applications of the single and compound based fertilizers. Significant ($p < 0.05$) differences were detected among the maize genotypes evaluated and among the different fertilizers as well as among their interactions for the number of seeds per cob/fruit, days to physiological maturity and fresh cob/fruit weight (g). Yield components such as days to 50% flowering, number of cobs per plant and 100 seed weight did not differ significantly among the maize genotype evaluated and among the fertilizer treatments applied. Number of seeds per plant varied ($p < 0.05$) significantly from 153.3 in Oba super 6 maize genotype treated with NPK to 195.30 seeds in the hybrid yellow maize genotype treated with single super phosphate. Days to physiological maturity for the maize genotypes also differed ($p < 0.05$) significantly from 113 days in hybrid yellow maize in single super phosphate treatment to 121 days in Oba super 6 maize genotype with single super phosphate. Fresh cob/fruit weight of 213.70 g was obtained from local white maize treated with urea while 465.12 g was the fresh cob weight measured from hybrid yellow maize genotype treated with single super phosphate fertilizer.

Although the yield attribute of days to 50% flowering, number of cobs per plant and a 100 seed weight did not show any statistical significant ($P > 0.05$) differences among the evaluated genotypes, Oba super 6 genotype treated with urea required on the average 73.70 days to flower while the local white maize treated with NPK required 79.70 days to flower.

It was also gathered from the study that only the Oba super 6 maize genotype treated with single super phosphate had 2 cobs per plant all the others had just one cob per plant while, 100 seeds weight among the evaluated genotypes varied between 61.65 g in the local white maize treated with NPK compound fertilizer to 67.6 g in the hybrid yellow maize treated with single super phosphate fertilizer (Table 3.4).

3.4 Incidence of Army Worm on Maize Genotypes as Influenced by the Application of Single and Compound Based Fertilizers

Table 3.5 presents results on the incidence of army worm of three maize genotypes grown on soils treated with single and compound based fertilizers of urea, single super phosphate and NPK. The results indicated that the incidence of army worm in maize genotypes were significantly influenced

by the applications of the single and compound based fertilizers. Significant ($p < 0.05$) differences were detected among the maize genotypes evaluated and among the different fertilizers as well as among their interactions for the number of percentage incidence of army worm based on the number of holes counted on the leaves and stems of maize.

The incidence of army worm was high across the control plots while plots treated with the compound fertilizer NPK showed the least percentage incidence of army worm.

4. Discussion

4.1 Characteristics of the Soil Used for the Study

The result of the analysis of the soil used for the study is presented in (Table 3.1). The soil was moderately acidic with a soil pH of 5.3, organic carbon 6.12%, CEC was 1.22 cmol kg⁻¹ while total nitrogen (N) and available phosphorus (P) were 0.08% and 6.15 mg kg⁻¹ respectively. The soil was sandy loam (sand 65%, silt as 232 gkg⁻¹ and clay as 145 gkg⁻¹), Total N and available P contents were very low compared with the critical levels of 0.1% for N and 10-12 mg kg⁻¹ for available P, (FAO, 1976) obtained for soils in southeastern Nigeria. Using the critical level of 0.2 cmol kg⁻¹, exchangeable K was low (Unamba, 2005) and using the FAO (1976) established critical values for nutrients in these soil, the soils were deficient in N, Ca, Mg and K, with respect to maize production, which could be due to long term cropping of the land.

4.2 Effect of NPK Fertilizer Rates on Growth Parameters of Maize

Height is one of the significant characteristics associated with the productive potentials of a plant in terms of fodder, and fruit yield. The response of maize genotypes to single and compound fertilizer treatment was statistically significant as evident from this study (Ubi & Ubi, 2004). Plant vegetative growth have been widely reported to be significantly influenced by nitrogen nutrient which is the bulk of the nutrient element in urea single based fertilizers and this significantly influenced all the taller plants than other fertilizer treatments like the compound NPK and SSP under similar experimental conditions. This finding agrees with the reports of Ayeni *et al.* (2008a), whose results showed similar poor yield attributes for maize planted with this treatment.

Results on the number of leaves per plant, leaf length, leaf width and leaf areas were significantly ($P < 0.05$) influenced by the treatment combinations of maize genotypes and fertilizer applications. The results showed higher growth attributes under urea single based fertilizer than the compound fertilizer. This is in agreement with the findings of (Chisto & Onuh, 2005 and Philip *et al.*, 2010). The wider spacing of 70 × 40 cm provided sufficient opportunity for the maize roots to feed extensively within the nutrient water solution level without interrupting and competition, and this might have resulted in an enhanced shoot development with highest cob yield (75.56 t/ha⁻¹) which was significantly ($p < 0.05$) higher than all other values obtained from other spacing's during the study.

Table 3.3: Growth performance of maize genotypes as influenced by single and compound fertilizer application

Maize genotype + fertilizer	Plant height (cm)	No of leaves/ plant	Internode length (cm)	Leaf width (cm)	Leaf length (cm)	Leaf area (cm ²)
A1B1	164.40 a±2.40	12.00 b±1.33	8.00 b±2.33	9.90 b±1.00	54.40 b±0.40	538.56 b±16.40
A1B2	157.20 b±2.05	8.70 c±0.57	6.90 a±1.23	7.80 d±0.57	47.40 d±1.00	367.72 c±3.98
A1B3	157.01 b±2.04	9.00 c± 1.00	7.80 a±1.65	7.70 c±0.57	50.10 c±0.57	385.77 b±2.40
A2B1	168.00 a±1.87	16.33a± 0.33	9.70 a±0.76	12.45 a±0.88	74.13 a±0.88	922.92 a±0.57
A2B2	103.50 b±0.89	10.70 c±3.48	8.60 a±2.11	10.20 b±2.10	53.22 b±2.42	542.84 b±1.00
A2B3	123.50 c±3.11	12.00 b±0.87	9.60 a±1.45	7.90 c±0.54	50.30 c±1.67	397.37 c±12.85
A3B1	115.30 d±1.87	9.30 c±1.55	6.30 a± 1.88	6.40 d±1.00	40.41 e±0.61	258.62 d±6.98
A3B2	99.60 e±2.34	8.00 c±2.54	6.00c±2.11	7.67 b±0.34	34.98 e±1.00	268.29 d±13.64
A3B3	103.00 e±1.53	9.70c±0.57	9.30 a±1.77	5.27 e±0.67	39.45 d±2.30	207.90 d±8.78
LSD (0.05)	10.44	1.08	0.91	1.34	4.45	96.88

Key: A₁ = Oba super 6 maize variety; A₂ = hybrid yellow maize; A₃ = local white maize; B₁ = urea fertilizer; B₂ = single super phosphate; B₃ = NPK fertilizers

This support the earlier reports of Tindall, (1983); Kochhar, (1986); Youdeowei *et al.*, (1989) who all opined that wider spacing improves feeding area of the plant and enhances plant growth and development. The effectiveness of the synthetic insecticide is a confirmation of the report by Philip *et al.*, (2010) that chemicals have been the primary control agent for agricultural pests. However, the mean number of *B. fusca* population was significantly reduced in plots treated with inorganic compound and single fertilizers when compared with the control experiment indicating that maize could be adequately protected against *B. fusca* infestation by timely application of inorganic chemicals such as fertilizers, and other pesticides to increase maize and food production in Nigeria.

Moreover, the application of the compound NPK fertilizer resulted in an enhanced plant growth and development such that values obtained from number of leaf blades/plant, leaf area and number of cobs per plant tended to be significantly higher in plots treated with compound NPK fertilizer than in either those treated with single fertilizers under similar conditions. This is in line with Ubi & Ubi, (2004) findings. The hybrid yellow maize genotype was the most prominent of all the evaluated genotypes while urea single based fertilizer supported the most vegetable growth of all the evaluated genotypes. However, fruit yield saw a single super phosphate dominating influence in terms of higher fruit yield performance in all the evaluated genotypes. The hybrid yellow maize genotype also performed best in terms of yield performance.

5. Conclusion

The present study has shown that all the maize genotypes used for the experiment performed significantly well in terms of the growth and yield traits evaluated. The concentration of the total genomic DNA in the maize genotypes varied significantly with the hybrid yellow maize genotype having the highest concentration of total genomic DNA compared to the local white maize genotype which had the least concentrations of total genomic DNA. Hence, in terms of genomic DNA concentrations hybrid yellow maize > Oba super 6 > local white maize genotype. Similarly, in terms of the growth attributes evaluated for plant height, internode length, leaf length, leaf width, leaf area and number of leaves per plant, hybrid yellow maize > Oba Super 6 > local white maize while urea > NPK > SSP for the growth attributes. For the yield attributes Hybrid yellow maize > Oba Super 6 > local white maize while SSP > NPK > urea in terms of fruit yield. The incidence of army worm was virtually higher in all the control plots and least in plots treated with the NPK compound fertilizer. From this study, compound fertilizers had significant effect on growth and yield performance, pest incidence and DNA concentration in maize grown in the rain forest ecology of Southern Nigeria. The result of this study showed that maize equally responds well to adequate single fertilizer application in terms of the growth to urea fertilizer and fruit yield to SSP fertilizer.

Based on the result and findings from the present study, it could be recommended that for good growth and yield of maize in this ecology, the hybrid yellow maize should be cultivated with single base fertilizers like urea and single super phosphate in lieu of spending huge resources buying compound fertilizer as it may be a waste of resources rather. Also for the consumption of superior quality maize genotype, the hybrid yellow maize with high genomic DNA should be used as a breeding stock for increased and improved yield and quality of maize crop as well as ensuring food security for our nation.

Table 3.4: Yield performance of Maize (*Zea mays* L) genotypes as influenced by single and compound based fertilizer applications

Genotypes/ Treatment	Days to 50% Flowering	No. of seeds per cob	Days to Maturity	No. of cobs per plant	100 seed Weight(g)/plot	Fresh cob Weight (g)/plot
A1B1	73.70	161.70e \pm 1.57	120.30a \pm 1.00	1.00	62.70	265.61e \pm 2.02
A1B2	75.30	180.00b \pm 0.03	121.30a \pm 1.00	2.67	64.30	298.54d \pm 2.02
A1B3	75.30	153.30f \pm 0.34	120.00a \pm 0.34	1.00	63.50	387.99b \pm 2.02
A2B1	75.30	159.70f \pm 3.33	113.70d \pm 0.57	1.00	67.60	270.80d \pm 2.02
A2B2	76.00	195.30a \pm 0.67	114.30c \pm 1.86	1.33	68.70	333.60c \pm 2.02
A2B3	76.00	189.00a \pm 1.00	115.30c \pm 1.33	1.00	65.60	456.70a \pm 2.02
A3B1	79.70	179.70d \pm 0.57	120.70a \pm 2.67	1.00	63.70	213.70f \pm 2.02
A3B2	79.00	179.60d \pm 0.57	118.00b \pm 1.09	1.00	66.10	258.70e \pm 2.02
A3B3	79.70	164.00e \pm 1.00	117.00b \pm 1.23	1.00	61.65	273.70d \pm 2.02
LSD (0.05)	NS	4.44	5.06	NS	NS	36.21

A₁ = Oba super 6 maize variety; A₂ = hybrid yellow maize; A₃ = local white maize; B₁ = Urea fertilizer; B₂ = Single super phosphate; B₃ = NPK fertilizers

Table 3.5: Incidence of Armyworm on Maize

Armyworm incidence	Urea				SSP				NPK			
	Control	B1	B2	B3	Control	B1	B2	B3	Control	B1	B2	B3
% incidence	17±0.39	8±0.36	6.5±0.35	4.4±0.21	14±0.48	1.8±0.39	1.7±0.35	1.4±0.28	10 ±0.48	0.8±0.39	0.6±0.35	0.4±0.28

Key: B₁ = Urea fertilizer; B₂ = Single super phosphate; B₃ = NPK fertilizer

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