



Evaluation of the efficacy of different concentration of super gro (bio- fertilizer) on productivity of maize (*Zea mays*) in Gombe, Gombe State

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Abstract

Field experiment was conducted during the 2019 cropping season at a community based demonstration farm Kwodom, Yamaltu Deba Local Government Area of Gombe State, Nigeria, on evaluation of the efficacy of different concentration of super gro (Bio-fertilizer) and maize variety on productivity of maize (*Zea mays* L-). The treatments consisted of three different concentration of supergro (bio-fertilizer) 50ML, 100ML and 150ML and three varieties of maize which are; SAMMAZ17 (V1), SAMMAZ25 (V2) and SAMMAZ34 (V3). The experiment was laid out in a split plot design with three treatments of supergro (bio-fertilizer) 50, 100 and 150 ml/litres of clean water assigned to the main plot while the three maize varieties were assigned to the subplots; these were replicated three times. Data were collected on growth and yield attributes of maize plant. Data collected were analysed using analysis of variance (ANOVA) and treatment means compared with least significant difference at 5% probability level. 150ml recorded the tallest plant height followed by 100ml and SAMMAZ 17 followed by SAMMAZ 34 respectively.

Keywords: Super gro (bio-fertilizer), maize variety, evaluation, productivity

Introduction

The gradual paradigm shift towards organic agriculture cannot be over emphasized especially now that the world is facing overwhelming challenges in the wake of record food prices, climate change and global warming, sustainable food production remains vital for Africa's development and economic growth.

Bio fertilizer can be defined as a substance which contains effective living micro-organisms (EM) which colonize the rhizosphere or the interior of the plant and promote growth by increasing the supply of primary nutrients and growth stimulus to the target crops when it is applied to seeds, plant surface and soil. It is biodegradable and leaves no harmful residue on the products of the crops and plants. Unlike chemical fertilizers, Super Gro being natural fertilizers does not have chemicals that could leave any harmful on the soil.

Super Gro (bio-fertilizer) act as both an adjuvant and a surfactant by reducing the surface tension of water. In addition, it acts as a wetting agent. Super Gro makes water wetter by reducing its surface tension. It also helps to conserve water by increasing the rate at which water penetrate into soil. It makes other agricultural treatments a farmer uses like fertilizer; insecticides and pesticides perform better by helping them penetrate deeper, stick better, stay longer and work residue more effectively.

Maize (*Zea mays* L.) belongs to the grass family Poacea and believed to have originated from Mexico or Central America and spread to West Africa by early European traders in the 16th century (Langner *et al.*, 2017). It is the world's third most important crop after rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.) in terms of annual production maize ranked first (Guzzon *et al.*, 2015) [3]. A total of 951.6 million metric tonnes of maize were produced worldwide, 1.5 tonnes/ha in Africa, 1.7 tonnes/ha in India, slightly more than 3 tonnes/ha in Latin America, 12.5 tonnes in the USA and Nigeria with an annual production of 11.3 tonnes/ha (FAO, 2017). Maize is the most cereal crop in Sub-Saharan Africa (SSA). It is high yielding, easy to process, readily digested and cheaper than other cereals. It is also a versatile crop growing across a wide range of agro- ecological environments.

Every part of maize plant has economic value; the grain, leaves, stalk, tassel and cob can all be used to produce a large variety of food and non-food products. In industrialized countries, maize is largely used as livestock feed and as raw material for industrial products, while in developing countries it is mainly used for human consumption and poultry feed. In Sub-Saharan African (SSA), maize is a staple food for estimated 56% of the population and provides 44% of basic caloric requirement. It is an important source of carbohydrate, protein, iron, vitamin A, B, C, E and minerals (Sinebo, 2014) ^[10]. Africans consume maize as a starchy base in a wide variety of food such as porridge, pastes, grits etc. Green maize (fresh on the cob) is eaten parched, baked, roasted or boiled, playing an important role in filling the hunger gap after the dry season (Sinebo, 2014) ^[10].

It is low in calcium and fairly high in phosphorous (Baquest *et al.*, 2013) ^[11]. In developed countries like America maize is used to produce ethanol (ethyl alcohol), a first generation liquid bio fuel. Corn ethanol is typically blended with gasoline to produce "gasohol" an automotive fuel that is 10 per cent ethanol, cobs are also used as a biomass fuel source. Maize is used in the biochemical industry, can be hydrolyzed and enzymatically treated to produce syrups (corn syrupe) and pharmaceutical industry (Ranere, 2014) ^[9]. In Germany as a feedstock for biogas plants. Austria began in 2005 a research is being done to make diesel out of the biogas (FAOSTAT, 2014) ^[12].



Fig 1

Materials and Method

Field experiment was conducted during the rainy season of 2019 at a community based demonstration farm Kwodon, Yemaltu Deba Local Government Area of Gombe State, Nigeria. Gombe (latitude 10° 15' N and longitude 11° 10' E (Kwari and Rayar, 2014 and 380 m above sea level) located in the northern guinea savannah ecological zone of Nigeria. Whose soil is predominantly sandy. Gombe has mean annual rainfall ranges from 850 – 1000mm from the months of (May to October) while dry season dominates the remaining period of the year. Northern Guinea Savannah has been a region with abundant sunshine throughout the year except between the months of August and September and during harmattan, when frequent cloud cover and haze obstruct solar radiation most of the day time (Kowal and Knabe, 2015) ^[5]. The treatments consisted of three concentration of Super gro bio-fertilizer (50,100 and 150ml/ litres of clean water) and three maize varieties (SAMMAZ-17- (V₁), SAMMAZ- 25 – (V₂) and SAMMAZ-34- (V₃). The experiment was laid out in a

randomized complete block design (RCBD) with three replications. The total experimental area was 21m x 54m (1134m²). Each plot size was 3m x 3.5m (10.5m²), 2m path way between replications and 1m path way between plots, the total number of plots per replication is 22 plots x 3 replications = 66 plots in all. Super gro (bio- fertilizer) was allocated to the main plots while maize varieties were allocated to the subplots. Manual hoe weeding was done at 3, 6, 9 and 12 WAS to keep the experimental plots weed-free (Dugje *et al.*, 2014). Growth parameters like Plant height and Number of leaves per plant were taken from five randomly selected tagged plants in each plot and the mean recorded. Yield data per plant such as Number of grain per cob, Number of grain per row and seed yield per hectare.



Fig 2



Fig 3



Fig 4



Fig 5

Results and Discussion

Physical and chemical analysis of the soil (Table 1) revealed that the texture is loamy sand with sand, clay and silt contents of 75.11, 21.6 and 16.1 respectively. The soil is slightly acidic, low in Mg, Na, K but medium in Ca, organic carbon and N than the soil of the experimental site (Table 1).

Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) Table 2: On plant height was significant ($P \leq 0.05$) at 6 and 12 WAS where 150ml produced the tallest plant with 161.26 cm followed by those received 100ml gave 74.48cm while in maize varieties SAMMAZ 34 recorded the tallest respectively.

Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on number of leaves per plant showed significantly ($p \leq 0.05$) higher at 6 and 9 WAS as shown on Table 3 plant received 100ml concentration produced more leaves than others with the value of 13.42 leaves followed by 150ml with 13.25 leaves, while in term of varieties SAMMAZ 25 indicated more leaves with 14.32 leaves the least goes to SAMMAZ 17.

Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) showed significant ($p \leq 0.05$) evaluation on number of grain per cob on (Table 4) which 100ml

indicated the highest number of grains with 395.5 followed by 150ml whereas in issue of varieties SAMMAZ 25 gave the highest.

Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on number of grain per row on (Table 5) which revealed that there was no significant ($p \leq 0.05$) evaluation on number of grain per row throughout the counting period.

Evaluation of the efficacy of different concentration of super

gro (bio-fertilizer) on seed yield/ha (kg/ha) on (Table 6) plants that received different concentration of super gro at 150ml/ha produced the highest number of total seed yield of 3,187.6kg/ha followed by those applied 100ml/ha with 2,913.2kg/ha while the least value recorded was 50ml gave 2,934 respectively. In varieties SAMMAZ 17 recorded the highest value with 3,135.6 grains and the least goes to SAMMAZ 25 indicated 3,040 grains.

Table 1: Physical and Chemical properties of soil used for the experiment at Gombe in 2019 rain fed season

Properties	Value
Sand (%)	75.11
Clay (%)	21.6
Silt (%)	16.1
Soil P ^H	6.50
Organic matter (%)	2.11
Ca ²⁺	2.31
Mg ²⁺	0.56
Na ²⁺	0.28
K ²⁺	1.05
Zn (mgkg ⁻¹)	4.48
Available p (mgkg ⁻¹)	5.32
Organic carbon (%)	4.34
Total Nitrogen (%)	2.30
Cation exchange capacity (CEC) mg kg ⁻¹	5.26
Texture	Sand loam clay

Table 2: Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on plant height at 3, 6, 9 and 12WAS at Kodon in 2019 rain fed cropping season

Treatment	3WAS	6WAS	9WAS	12WAS
Super gro(bio-fertilizer)				
50ml	21.34	60.43	96.54	143.07
100ml	30.40	69.23	105.54	152.01
150ml	34.27	74.48	114.0	161.26
P>F	0.02	0.34	0.007	0.12
LSD	4.70	6.83	7.05	7.64
Variety (v)				
SAMMAZ 17	13.04	62.30	120.3	129.5
SAMMAZ34	12.46	61.36	135.48	138.57
SAMMAZ25	9.67	58.06	126.0	127.4
P>F	0.18	0.21	0.16	0.19
LSD	5.63	4.06	20.29	43.78
Interaction				
SPGR@50ml	17.63	43.52	59.47	75.47
SPGR@100ml	26.74	51.04	77.78	104.52
SPGR@150ML	34.74	59.04	93.78	128.7

Foot note: SPGR = Super gro (bio-fertilizer)

WAS = Weeks After Sowing

NS =Not Significant

Table 3: Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on number of leaves at 3, 6, 9 and 12WAS at Kodon in 2019 rain fed cropping season

Treatment	3WAS	6WAS	9WAS	12WAS
Super gro(bio-fertilizer)				
50ml	3.80	7.33	13.42	13.70
100ml	3.18	7.12	13.64	14.06
150ml	3.42	6.34	13.86	13.43
P>F	2.25	0.34	4.12	0.25
LSD	1.02	0.74	2.01	4.53
Variety (V)				
SAMMAZ17	3.76	7.65	12.21	10.87
SAMMAZ34	3.62	7.95	12.27	10.62
SAMMAZ 25	3.74	7.38	13.42	10.75
P>F	0.006	2.35	0.01	2.12

LSD	0.18	0.40	0.53	0.24
Interaction				
SPGR @ 50ml	7.68	10.23	10.27	11.61
SPGR @ 100ml	8.53	9.11	11.05	12.00
SPGR @ 150ml	9.07	10.00	11.42	11.06

Foot note: SPGR = Supergro (bio-fertilizer)

WAS = Weeks After Sowing

NS =Not Significant

Table 4: Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on Number of Grain per Cob and Number of Grain per Row in Kodon in 2019 rain fed cropping season

Treatment		
Super gro (bio-fertilizer)	no of grain per cob	no of grain per row
50ml	366.2	13.30
100ml	395.5	13.42
150ml	368.10	13.71
P>F	0.35	0.24
LSD	0.18.	0.63
Variety (V)		
SAMMAZ17	375.8	13.75
SAMMAZ34	363.4	13.22
SAMMAZ25	390.8	0.17
Interaction		
SPGR @ 50ml	7.68	13.23
SPGR @ 100ml	8.53	9.11
SPGR @ 150ml	9.07	10.00

Foot note: SPGR = Supergro (bio-fertilizer)

WAS = Weeks After Sowing

NS =Not Significant

Table 5: Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on yield/ hectare in Kodon in 2019 rain fed cropping season

Treatment	
Super gro(bio-fertilizer)	Yield/hectare (kg)
50ml	2,934
100ml	3,187.6
150ml	2,913.2
P>F	0.18
LSD	0.74
Variety (V)	
SAMMAZ17	3,135.6
SAMMAZ34	2,859.2
SAMMAZ25	3,040
Interaction	
SPGR @ 50ml	1,206
SPGR @ 100ml	2,115
SPGR @ 150ml	2.852

Foot note: SPGR = Supergro (bio-fertilizer)

WAS = Weeks After Sowing

NS =Not Significant

Discussion

Evaluation of the efficacy of different concentration of super gro (bio-fertilizer) on productivity of maize was significant with the application of different concentration of bio-fertilizer. The response exhibited by maize to different levels of super gro application as observed by increase in plant height, number of leaves, number of grain per cob, number of grain per row and seed yield per hectare could be attributed to the ability of bio-fertilizer in promoting vegetative growth as an important chlorophyll, amino acids and nucleic acid enhance plant's growth and development. This is in conformity with the findings of Okpara *et al.*, (2015) [8] and

Haruna, (2016) [4] who reported that significant increase in growth characters such as plant height and number of leaves due to super gro (bio-fertilizer) application. Bio-fertilizer application also increased yield attributes such as number of grains per cob, number of grains per row and seed yield. This may be due to the availability of bio-fertilizer which enhances production and translocation of dry matter from source to sink (Akinrinde, 2016).

Conclusion

Results from this study revealed that growth and yield parameters of maize were significantly increased in response to the application of super gro (bio-fertilizer). Plant height, number of leaves, gave the highest yield at 150ml and variety SAMMAZ 17 recorded the highest yield. This result can conclusively said that maize yield depended on super gro (bio-fertilizer) and variety used as other factors such as soil nutrient level, type of climatic factors and zone of production requires.



Fig 6

Recommendations

Based on the finding from the study the following recommendation can be made:

1. Farmers should always grow maize with super gro (bio-fertilizer) which is a natural liquid fertilizer developed to ensure the enhancement of crops and improve agricultural productivity.
2. It also functions as an adjuvant/surfactant that enables more water to reach the roots of the plant, It is also a natural wetting agent, easily penetrable into tissues for rapid effect, making "water wetter", boosting its ability to deliver life-sustaining moisture deeper into the plant root systems.
3. This will increase your agricultural yield more than three

times of what you would get from synthetic or chemical fertilizers. Super gro makes other agricultural treatments, farmers use (like fertilizer, insecticides and pesticides), perform better by helping them penetrate deeper, stick better, stay longer and work more effectively. Bio-fertilizer of 150ml and maize variety of SAMMAZ 17 is recommended for farmers in Gombe for optimum production of maize.

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