THE EFFICACY OF CRYSTALLIZER ON THE GROWTH OF MAIZE IN MAKURDI, SOUTHERN GUINEA SAVANNA AGRO-ECOLOGICAL ZONE OF NIGERIA

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ABSTRACT
Maize (Zea mays) is an important cereal crop providing staple food for human consumption. It is undoubtedly an important source of food for National Food Security programme. Deleterious effects of environmental and health hazards occurred by the use of chemical fertilizer and its attendant high cost limits its use by the average farmer, consequently resulting in reduced yields. The use of crystallizer fertilizer is yet to be fully appreciated in this zone. A field experiment was conducted at the Teaching and Research Farm of University of Agriculture Makurdi during the 2011 cropping season to evaluate the effect of crystallizer on the growth of hybrid maize. Treatments comprising of control (0.0t/ha), 0.5t/ha, 1.0t/ha, 1.5t/ha were used. The five (5) treatments were investigated and replicated three (3) times. The data collected were on plant height, leaf length, leaf width and leaf numbers. Results indicated significant difference of all the parameters investigated with other fertilizer plant height, leaf length, leaf width, treatment of 1.5t/ha and 2t/ha were not significantly different. The application of 2t/ha is therefore recommended. The use of crystallizer can be explored for other crops in the region.

INTRODUCTION
Maize (Zeamays) is an important staple food for human and animal consumption. It is grown in most part of the world (Tsamo, 2005 and Idikut *et al*., 2009). This research was conducted during the 2011 cropping season at Teaching and Research Farm, University of Agriculture Makurdi, Benue State. Looking at the environmental and health hazards arising from chemical fertilizer usage, effort has been placed on the application of organic based fertilizers in this experiment. The use of crystallizer is a newly developed organic based fertilizer product in maize production has not been studied adequately in the Guinea savanna Zone of Nigeria. Yet fertilizer studies are soil, climate and crop

specific. It is on this basis that this study is carried out to investigate the effect of crystallizer on the growth of hybrid maize in the Guinea savanna agro-ecological of Nigeria.

Aims and Objectives of the Study

The broad objective of this study is to evaluate the effect of crystallizers on the growth and yield of hybrid maize.

The specific objectives include;

i. To determine the effects of crystallizer on the soil physical and chemical properties in the study area.
ii. To assess the effect of crystallizers on the growth of maize

Materials and Methods

Experimental Site

The experiment was carried out at the Teaching and Research Farm of the Federal University of Agriculture, Makurdi during the 2011 cropping season.

Makurdi is located at latitude 7.41°N and longitude 8.37°E on an elevation of 97m above sea level. This location lies within the Southern Guinea Savanna Agro ecological Zone.

The zone is characterized by distinct rainy and dry season. The rainy season start in April and ends in October while the dry season begins in November and ends in March. The annual rainfall total varies from 1000-1250mm with most of it occurring in the month of June and September.

Experimental Treatments and Design

There were a total of five (5) treatments that were laid in Randomized Complete Block Design (RCBD) and replicated three (3) times. Each replication consists of fifteen (15) plots measuring 4m x 5m ($20m^2$) with an alley of 0.5m between the plots and in between replications. This gave a total land area of (21.5m x 3m) = 64.52m.

Cultural Practices

Weeding was done manually with the use of hoe at l4 day's and 2l days after planting to keep the field free of weeds during the growing season. The treatment (crystallizer) was applied two weeks after planting by ring method per plant. The treatment was applied at the rate of Ti = which is the control (no application), T2 = 0.5 ton/ha, T3 = 1.0 tort/ha, T4 = 1.5 tort/ha and T5 = 2.0 ton/ha for the five plots respectively. The field borders were kept clean to minimize encroachment by insects and rodents.

Data Collection

Data collection started two weeks after the treatments were a1plied. Growth and yield parameters recorded at different stages of crop growth and development were; plant height, leaf area, number of leaves, number of grain per plot and grain yield. These

parameters were determined in the following ways at the 2nd 4th 6th 8th and the 10th weeks after planting.

Soil Data Collection

Soil samples were collected from 0-15cm depth first as composite at planting and then at harvest based on the treatments. A total of six (6) samples were collected. The samples were air dried, crushed and sieved using 2mm sieve and stored in polythene bags ready for laboratory analysis. All the data were analyzed statistically using the analysis of variance (ANOVA) producers. The treatment means were separated using the Duncan Multiple Range Test (DMRT) at 5% level of probability.

All data analysis was carried out in the NICASOL laboratory of Federal University of Agriculture Makurdi, Benue State. 20g of soil sample was weighed and 20m1 of distilled water added to it and stirred using glass rod for at least 30 minutes. The electrode of the pH meter was inserted into the partly settled suspension and the reading was taken the ratio is 1:1.

Result and Discussion

Soil Characteristic

The result of the soil physical and chemical properties as affected by fertilizer treatments is presented on table. The textural class of the soil is loamy sand. The initial PH (KC1) was 5.07 which can be described as being moderately acidic. The organic matter content is high (4.11%) but the percentage N (0.098), P (2.48Cmol/kg) and K (O.36Cm6l/kg) as well as Ca (2.7OCmol/kg) and Mg (1 .42Cmol/kg) was low. At the end of the experiment, crystallizer application affected the soil physical and chemical properties variably:

Increased level of application of the crystallizer slightly increased the PH of the soil from 5.85(H20) at the beginning of the experiment to about 5.94 thereby decreasing the acidity of the soil. The effect of crystallizer treatment on soil organic matter content was not significantly different from what was obtainable before the experiment. However, compared with the control, crystallizer" slightly improved the soil organic matter content. In the same manner, crysta1lizer application did not improve the soil content of nitrogen. The effect of crystallizer application on soil chemical properties was more pronounced on the P and Mg content of the soil. It is more or less doubled the amount of K in the soil at the end of the experiment from about 2.48Cmol/kg to 4.43 Cmol/kg when 2.0t/ha of crystal1izer was applied. The Mg content was increased from about

1.20 Cmol/kg of soil to 1 .57Cmol/kg of soil. The K content of the soil was also improved by the application of the crystallizer from about 0.30Cmol/kg of soil to about 0.5Cmol/kg of the soil. There was also a slight improvement of the CEC of the soil from 4.50Cmol1/kg to 5.80Cmol1.kg. However, crystallizer® treatment did not affect the textual composition of the soil and did not also affect the percentage base saturation of the soil.

TABLE 1: This shows the physical and chemical properties of the soil

SOIL PROPERTIES	
Particles size distribution (%)	
Sand	79.2
Silt	11.1
Clay	9.7
pH 1.1 (H_2O)	5.07
organic carbon (%)	2.36
soil Organic Matter (%)	4.11
total Nitrogen (%)	0.098
phosphorus (mgkg-1)	2.48
exchangeable cation (Cmol/kg-1)	
Ca	2.70
Mg	1.42
Na	0.66
K	0.36
CEC	2.25
Base saturation (%)	
Textual class	Loamy SAnd

TABLE 2: PHYSICAL AND CHEMICAL PROPERTIES OF THE SOIL AFTER THE EXPERIMENT

Particles size distribution

TREATMENT	% Sand	% SILT	% CLAY	TEXETUAL CLASS	pH H_2O	KCL 1:1	Org C%	Org M%	N%	Bray-1 1p	Ca	Mg	K	Na	CEC	Base Sat (%)s
1	65.6	15.2	19.2	sandy loan	5.99	5.18	2.09	3.62	0.098	4.35	2.38	1.20	0.30	0.65	4.95	98.9
2	77.3	17.3	15.2	sandy loam	5.83	5.05	2.55	4.42	0.112	4.2	2.4	1.37	0.41	0.59	4.80	97.5
3	78.1	12.3	9.6	loamy sand	5.98	5.20	2.41	4.30	0.091	3.3	2.29	1.10	0.26	0.44	3.50	91.4
4	67.2	17.4	15.4	sandy loam	5.97	5.11	2.19	3.79	0.105	3.08	3.21	1.68	0.50	0.70	6.30	97.6
5	69.4	14.3	15.3	sandy loam	5.84	5.10	2.39	4.14	0.084	4.43	3.11	1.57	0.40	0.60	5.80	98.1

Effect of crystallizer on maize plant height (cm)

Table 3.At 2 weeks after planting, 2.0t/ha of crystal1izer application significantly affected the maize plant height. 2.0t/ha significantly produced the tallest plant followed by maize plants treated with 1 .5t/ha of the organic industrial base fertilizer. However, the result obtained from 2.0 and 1 .5t/ha are not significantly (P>0.05) different from each other. However, there were significantly higher than plots treated with 1 .0 t/ha of crystallizer while the control had shortest plants. The same treatment was maintained at 4 and 6 WAP. Where 1.5 and 2.0t/ha application significantly produced tallest plants followed by plots treated with 1 .0 t/ha and then the control plot had the shortest plant height. At 8WAP 2.0t/ha treatment produced the tallest plant over the 1 .5t/ha treated plots. The control had the lowest followed by 0.5t/ha and 1 .0t/ha respectively. At the 10WAP, plants height of plots treated with 2.0, 1.5, and 1 .0t/ha had similar heights that were significantly taller than plots treated with 0.5t/ha and the control plots.

TABLE 3: Effect of different rates of crystallizer on the height of maize plant (cm)

TREATMENT	2WAP	4WAP	6WAP	8WAP	10WAP
Control	12.50c	31.10c	49.60c	88.60c	111.50c
0.5t/ha	13.00c	33.07c	52.67c	104.14c	157.67b
1.0t/ha	22.67b	43.67b	65.00b	100.62c	242.70a
1.5t.ha	29.63a	67.33a	90.67a	12.94b	246.00a
2.0t/ha	0.44a	66.00a	92.00a	163.67a	248.00a
$LSD_{0.05}$	4.09	7.22	8.82	27.09	116.12

WAP = Weeks after planting

Mean values followed by the same letters in a column are not significantly different from one another (F-LSD0.05) = Fishers least significant difference at 5% level of probability.

Effect of Crystallizer ® on Leaf Area (cm^2)

Table3. Show the effect of different rates of leaf area (cm^2) of maize at Makurdi, Nigeria. The 2.0t/ha of crystallizer significantly increased the leaf area of maize at 2 and 4WAP. However, AT 6-10 WAP, 1.0t/ha of crystallizer organic based fertilizer resulted in significantly higher leaf area in the maize compared to the other treatments. The lowest leaf area was obtained in the control plots at 2 and 6WAP, but at 4, 8 and 10WAP, 1.5t/ha gave significantly lower leaf area compared to the other treatments.

Table 4: Effect of Different Rates of Crystallizer ® on Leaf Area (cm^2) of Maize Plant

Treatment	2WAP	4WAP	6WAP	8WAP	10WAP
Control	21.20b	200.30c	468.30c	766.47b	976.23b
0.5t/ha	24.09b	267.80b	539.27c	822.00b	1097.73a
1.0t/ha	76.73b	361.40a	657.30a	910.93a	1123.87a
1.5t/ha	77.57b	169.07	568.75b	682.97c	800.07c
2.0t/ha	131.37a	378.13a	573.95b	705.77c	852.83c
$LSD_{0.05}$	116.12	61.19	75.02	37.11	35.18

WAP = Weeks after planting.
Mean values followed by the letters in a column are not significantly different from one another (F- LSD0.05) Fishers least significant different at 5% level of probability.

DISCUSSION

The results obtained from this study indicate that crystallizer is a good supplier of nutrients required by maize for its growth and development. It also shows that, the higher the rate of application, the higher the growth. This agrees with Pimentel *et al*. (2005) who reported that application of organic based fertilizer increases germination and produce greater seed vigour. This shows that application of organic based ferti1izer at planting stages improves the leaf area of maize. According to Spaccini *et al*. (2002), organic based fertilizers buffers soils and can increase water retaining ability of soils leading to enhanced germination and vigorous plant growth. Tasneem *et al*. (2004) reported that organic fertilizer application leads to vigorous seed growth. This indicates that leaf area of maize plants will increase as the application rate increases. The results further revealed that maize plants with no application of crystallizer had the lowest leaf area, and shows that organic based fertilizer supplies adequate nutrients for the growth of maize plants which is in accordance with Spaccini *et al*. (2002).

5.2 Recommendations

From this study it has been established that the use of crystallizer organic based fertilizer is beneficial to both the soil and plant. It is therefore recommended that for optimum yield of maize in the study area 2.Ot/ha of crystallizer is recommended. Further studies on the use of this product on other crops are also suggested.

REFERENCES

Idikut L., Atalay, A.I, Kara S.N and A.Kamalak (2009); Effect of hybrid on starch, protein and yield of maize grain. Journal of Animal and Veterinary Advances. 8(10): 1945-1947

Pimentel, D., P. Hepperly, J. Hanson, D. Doulds and R. Seidel (2005). Environmental, Energetic, and Economic comparisons of organic and conventional farming systems. Bio science. Pp. 01.55, No.7, pages 573-582.

Spaccini,R.A., Piccolo, j.s.c., Mbagwu, T. A. Zena, and C.A. Igwe.2002. Influence of addition of organic residues on carbohydrate content and structurally stability of some highland soils in Ethiopia. Soil use manages. L8:404-41 1.

Tasneem, K., Tariq, M., Kamala, J., and Masood, A. 2004. Effectiveness of farm yard manure, poultry manure, and Nitrogen for corn productivity. International journal ofAgricult:tre and Biology. 1560-853 0/2004/06-2-260-263.

Tsamo, C.V.P (2005):Moulds occurrence in maize (Zea-mays L.) grain and flours sold in the markets of Adamaoua province in Cameroon. National Advance School for Agro process Industry (ENSA) Ngaoundere University, Ngaoundere, Cameroon.