

Effect of Organomineral Fertilizer on the Growth and Yield of Tigernut Intercropped with *Amaranthus cruentus*

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Abstract: The growth and yield evaluation of tiger nuts (*Cyperus esculentus* L.) intercropped with *Amaranthus cruentus* and organomineral application was investigated in this study. Tiger nut tubers are locally known as “akiawusa” in Igbo, ‘aya’ in Hausa and ‘ofio’ in Yoruba. The research was carried out to determine the response of Tiger nut intercrop with *Amaranthus cruentus* fertilizer application (Organomineral fertilizer) and to evaluate the yield of tiger nut inter crop with *Amaranthus cruentus* in the soil. This experiment was laid out in a completely randomized design (CRD). Organomineral fertilizer was used at the rate of 40, 80 and 120 g per hectare. Parameters such as stem girth, number of leaves, plant height, were taken for 13 weeks. The treatments significantly influenced all the parameters assessed. The result showed that the plant treated with 120 g/kg organomineral fertilizer has the highest performance in all the parameters assessed while the control has the least performance. It can therefore be concluded that organomineral fertilizer at 120 g/kg is best to enhance and improve the growth and yield of tigernut intercropped with *Amaranthus cruentus*. *Cyperus esculentus* and *Amaranthus cruentus* can grow on a normal soil and environmental condition but the yield is greatly dependent on the available sufficient soil nutrient.

Keyword: Tiger nut, Completely Randomized Design, Organo-mineral fertilizer, *Amaranthus esculentus*

Date of Submission: 17-08-2020

Date of Acceptance: 03-09-2020

I. Introduction

Tiger nut (*Cyperus esculentus* L.) is an edible perennial grass-like native to the old world, and is lesser-known as vegetable that produces sweet nut-like tubers known as ‘earth almond’. Tiger nut (*Cyperus esculentus*) is a perennial grass-like plant with spheroid tubers, pale yellow cream kernel surrounded by a fibrous sheath. It is also known by various other names as chufa (in Spanish), earth nut, yellow nut, groundnut, rush nut, and edible galingale (Coskuner and others 2002).

Tiger nut (*Cyperus esculentus* L.) is one of nature’s super foods. They are high in fiber, highly nutritious and are believed to contain ingredients that can help prevent heart attacks and improve blood circulation. People in North Africa and Spain have been snacking on tiger nuts for centuries, Grossman and Thomas (1998). Grossman and Thomas (1998) reported that chufa came to Spain from Africa. Tiger nut is found wild and cultivated in Africa, South America, Europe and Asia. Tiger nuts grow in the wild, along rivers and are cultivated on a small scale by rural farmers mostly in the northern states of Nigeria.

This study is to determine the response of Tigernut intercrop with *Amaranthus cruentus* to organomineral fertilizer.

Tigernut is one of nature super food. They are fiber, highly nutritious and are belief to contain ingredients that can help to prevent heart attacks and improve blood circulation. And this tuber is rich in energy content, minerals, vitamins and vitamin C. It also helps to control blood pressure and help to regulate blood sugar level. Tiger nut milk can be used as cow milk substitute because they contain healthy fats and are nutritious (Adejuyitan, 2011).

II. Materials and methods

The experiment was carried out at the experimental site at Federal College Forestry, Jericho, Ibadan. The college is situated at Jericho hill, under North West Local Government Area of Oyo State. The area lies between latitude 7°26N and longitude of 3°54E. The Climatic condition of the area is tropically dominated by rainfall pattern from 1400-1500mm. The average temperature is about 30°C, average relative humidity of about 80-85% (FRIN, 2015).

The materials used for the experiment are as follows; Experimental bowl, organomineral fertilizer, cutlass, tiger nut (*Cyperus esculentus*) seeds, ruler, vernier caliper, recording book and training tread, watering can, *Amaranthus cruentus* seeds.

12 germination bowl of 15diameter was used for the experiment filled with 8 kg of soil, the soil was mixed with organomineral at the following rates 7days before planting was done, 40 g/kg, 80 and 120 g/kg of organomineral fertilizer. The experiment was laid out in a completely randomized design with four treatment replicated three times. Parameters such as plant height, number of leaves, stem girth, harvest weight were taken for the two plants. All data collected were subjected to analysis of variance (ANOVA) and significant means will be separated using Duncan multiple range test (DMRT).

III. Result and Discussion

Table 1 shows the physico-chemical properties of the topsoil used for the study. It shows that the soil is sandy loamy, slightly acidic based on the soil pH. Laboratory analysis report showed that the textural class of the soil is sandy loam soil, which shows that the soil has high water infiltration rate the table also shows that the exchangeable cations are readily available in the soil for plant growth and yield, this may lead to leaching of such cation in the soil. The extractable micro-nutrient in the soil showed that Mn is low with 56.5 mg/kg which is below critical level of 0.9-20 mg/kg while Fe is low with 5.7 mg/kg and Zn is high with 26.3 mg/kg because they are above the critical level of 25-30 mg/kg and 1.5-10 mg/kg and respectively (Ethiosis, 2014).

Table 2 showed that there was a significant difference among the treatment at week 2, the highest plant height mean was recorded in organo-mineral 120 g/kg having 29.33 cm while the least was recorded in the control having 21.83 cm who reported organo-mineral fertilizer increases the growth of plant. (Ayinla et al., 2018). The height at week one shows there is no significant difference among the treatment. The highest mean was recorded in treatment three and four having 4.33 cm while the least was recorded in treatment one having 3.33 cm. The height at week two shows there are significant difference among the treatment, and the highest mean was recorded in treatment four having 9.67 cm and not significantly different from treatment three 9.33 cm and the least was recorded in treatment one 7.00 and not significantly different from treatment two 7.83 cm

Table 1: Chemical Analysis of Topsoil Used for the Experiment

PARAMETERS	SOIL
pH	6.90
Sand (%)	74.50
Clay (%)	17.00
Silt (%)	8.50
O.C (%)	1.96
O.M (%)	3.38
TN (%)	0.17
P (mg/kg)	31.40
Ca (mol/kg)	26.30
Mg (mol/kg)	4.49
Na (mol/kg)	0.015
K (mol/kg)	0.11
Cu (mg/kg)	11.40
Mn (mg/kg)	56.50
Zn (mg/kg)	26.30
Fe (Mg/Kg)	5.70

Source: Soil Chemical Laboratory, Forestry Research Institute of Nigeria, Ibadan, Oyo state, 2020.

The height at week three shows there are significant difference among the treatment, the highest mean was recorded in treatment four having 15.83 cm while the least was recorded in treatment one having 10.67 cm. The height at week four shows there are significant difference among the treatment, the highest mean was recorded in treatment four having 20.50 cm while the least was recorded in treatment one having 14.00 cm. The height at week five shows there are significant difference among the treatment, the highest mean was recorded in treatment three and four having 22.67 cm while the least was recorded in treatment one having 16.33 cm. The height at week six shows there are significant difference among the treatment, the highest mean was recorded.

Table 2: Treatment effect on mean plant height of *amaranthuscruentus*

Treatment	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
1	3.33 a	7.00 b	10.67 c	14.00 b	16.33 b	18.63 b	21.83 a
2	3.67 a	7.833 b	11.50 c	15.00 b	18.00 b	21.97 ab	25.63 a
3	4.33 a	9.33 a	14.00 b	18.50 a	22.67 a	26.67 a	29.00 a
4	4.33 a	9.67 a	15.83 a	20.50 a	22.67 a	26.33 a	29.33 a
LSD	1.087	1.41	1.67	3.459	4.26	7.33	9.176

Table 3: Treatment effect on mean plant stem diameter of *Amaranthus crentus*

Treatments	4WAP	5WAP	6WAP	7WAP
1	0.14 b	0.17 b	0.23b	0.27b
2	0.20 a	0.20 b	0.27 b	0.30 b
3	0.17 ab	0.17 b	0.23 b	0.32 b
4	0.20 a	0.30 a	0.40 a	0.48 a
LSD (p= 0.05)	5.67	6.08	0.133	0.148

Treatment three having 26.67cm, while the least was recorded in treatment one having 18.63 cm. The height at week seven shows there are significant difference among the treatment, the highest mean was recorded in treatment four having 29.33 cm while the least was recorded in treatment one having 21.83 cm (Ayinla, *etal.*, 2018).

The readings start from week four because the leaf in week one, two and three have tender stem. The stem diameter at week four shows there are significant difference among the treatment, the highest mean was recorded in treatment two and four having 0.20 cm while the least was recorded in treatment one having 0.14 cm. The stem diameter at week five shows there are significant difference among the treatment, the highest mean was recorded in treatment four having 0.30 cm while the least was recorded in treatment one and three having 0.17 cm. The stem diameter at week six shows there are significant difference among the treatment, the highest mean was recorded in treatment four having 0.40 cm while the least was recorded in treatment one and three having 0.23 cm. The stem diameter at week seven shows there are significant difference among the treatment, the highest mean was recorded in treatment four having 0.48cm while the least was recorded in treatment one having 0.27 cm. Abbasdokht*etal.*, (2011).

Table 4.4 Treatment Effect on Mean Plant Number of Leaf of Tiger Nut

Treatment	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
1	3.33 a	5.67 a	7.00 b	7.67 b	8.00 b	9.00 b	9.33 bc
2	3.00 a	5.33 a	7.33 ab	8.00 b	8.33 b	8.67 b	9.00 c
3	3.33 a	5.33 a	8.33 a	11.00 a	13.00 a	13.00 a	14.00 a
4	2.67 a	5.00 a	6.67 b	7.67 b	8.33 b	10.67 b	11.33 b
LSD (p=0.05)	1.332	1.88	1.33	1.53	2.43	2.033	2.033

The number of leafs of tiger nut at week one shows there is no significant difference among the treatment. The highest mean was recorded in treatment one and three having 3.33 cm while the least was recorded in treatment four having 2.67 cm. The number of leaves of tiger nut at week two shows there is no significant difference among the treatment. The highest mean was recorded in treatment one having 5.67 cm while the least was recorded in treatment four having 5.00 cm. The number of leaves of tiger nut at week three shows there are significant difference among the treatment, the highest mean was recorded in treatment three having 8.33 cm while the least was recorded in treatment four having 6.67 cm. The number of leaves of tiger nut at week four shows there are significant difference among the treatment, the highest mean was recorded in treatment three having 11.00 cm while the least was recorded in treatment one and four having 7.67 cm. The

number of leaves of tiger nut at week five shows there are significant difference among the treatment, the highest mean was recorded in treatment three having 13.00 cm while the least was recorded in treatment one having 8.00 cm. The number of leaves of tiger nut at week six shows there are significant difference among the treatment, the highest mean was recorded in treatment three having 13.00 cm while the least was recorded in treatment two having 8.67 cm. The number of leaves of tiger nut at week seven shows there are significant difference among the treatment, the highest mean was recorded in treatment three having 14.00 cm while the least was recorded in treatment two having 10.6 cm.

Table 5: Treatment effect on means plant on the number of leaf of *Amaranthus crentus*.

Treatment	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP
1	2.67 a	6.33 a	8.33 b	10.00 b	10.00 ab	11.67 a	12.67 a
2	2.00 a	6.33 a	7.33 b	8.67 b	9.67 b	11.67 a	12.33 a
3	2.33 a	4.67 b	7.67 b	9.00 b	9.33 b	10.33 a	12.67 a
4	2.67 a	6.67 a	9.67 a	11.67 a	12.67 a	12.67 a	14.00 a
LSD(p=0.05)	0.94	1.08	1.087	1.53	2.977	4.24	5.07

In Table 5: The number of leafs for *Amaranthus Cruentus* at week one shows there is no significant difference among the treatment. The highest mean was recorded in treatment one and four having 2.67 cm while the least was recorded in treatment two having 2.00 cm. The number of leafs for *Amaranthus Cruentus* at week two shows there is no significant difference among the treatment. The highest mean was recorded in treatment four having 6.67 cm while the least was recorded in treatment three having 4.67 cm. The number of leaves for *Amaranthus Cruentus* at week three shows there is no significant difference among the treatment. The highest mean was recorded in treatment four having 9.67 cm while the least was recorded in treatment two having 7.33 cm. The number of leaves for *Amaranthus Cruentus* at week four shows there is no significant difference among the treatment. The highest mean was recorded in treatment four having 11.67 cm while the least was recorded in treatment two having 8.67 cm. The number of leaves for *Amaranthus Cruentus* at week five shows there is no significant difference among the treatment. The highest mean was recorded in treatment four having 12.67 cm while the least was recorded in treatment three having 9.33 cm. The number of leaves for *Amaranthus Cruentus* at week six shows there is no significant difference among the treatment. The highest mean was recorded in treatment four having 12.67 cm while the least was recorded in treatment three having 10.33 cm. The number of leafs for *Amaranthus Cruentus* at week seven shows there is no significant difference among the treatment. The highest mean was recorded in treatment four having 14.00 cm while the least was recorded in treatment two having 12.33 cm which is in line with the report of Agele*et al.*, (2016).

Table 6: Treatment effect on mean plant on the tiger nut fresh harvest weight.

Treatments	Tigernut weight
1	40.01d
2	48.57c
3	54.73b
4	66.49a
LSD	1.88

There is significant difference among the treatments of the harvested weight tiger nut. Treatment four had the highest yield weight of 66.49 and is significantly different to other treatments. The least yield was recorded in the treatment one application having 40.01.

TABLE 7: Treatment effect on mean plant on the number of seeds of tigernut

Treatment	number of seeds of tigernut
1	41.67d
2	51.67c
3	59.77b
4	75.57a
LSD	2.88

In the number of tiger nut seeds harvested, there are significant differences among the treatments. The treatment application of treatment two treatment three and treatment four had higher significant performance to treatment one. The treatment four application had the highest number of 75.57 and is significantly difference to the treatment two (51.67) and treatment three (59.77). The least number was recorded by treatment one having 41.67.

Table 8: Treatment effect on mean plant on the fresh harvest vegetable weight

Treatment	Fresh harvest vegetable weight
1	80.41c
2	108.51b
3	132.77a
4	148.67a
LSD	18.45

There is significant effect of the treatment application on the fresh harvest fresh weight of *Amaranthus cruentus* as the treatment application of treatment two, treatment three and treatment four have higher significant performance than treatment one application. The treatment three applications have the highest weight of 148.67 and is not significantly different from the treatment three application (132.77). The least weight was recorded in the treatment one application having 80.41. This result is in line with the result of Sridhar and Adeoye, (2003) that reported that organo-mineral perform better on *Amaranthus cruentus* yield.

IV. Conclusion

This study investigated the growth and yield response of *Amaranthus cruentus* L. intercropped with *Cyperus esculentus* L. to organo mineral fertilizer application. However, the treatments favorably influence.

It was evident that the application of organo mineral fertilizer played a vital role in the growth and yield of the crops. The significant response of the plant to applied fertilizer could be due to low organic matter content in the soil. The organo mineral fertilizer enrich the soil with NPK when decomposed, it also added organic matter to the soil to improve the structure, water holding capacity and cation exchange capacity of the soil. The experiment carried out shows that the application of 80g of organo mineral fertilizer performed best in all parameters accessed and indicated improvement in growth and yield of *Amaranthus cruentus* and *Cyperus esculentus*.

Based on the findings from this study, it is recommended that 80g application of organo mineral fertilizer can be used for the production of *Amaranthus cruentus* and *Cyperus esculentus* L. as it gave the highest growth and yield. The study also revealed that organomineral fertilizer can be gainfully used as a fertilizer by small farmers.

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Aderemi, F.T, et. al. "Effect of Organomineral Fertilizer on the Growth and Yield of Tigernut Intercropped with *Amaranthus cruentus*." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 13(9), 2020, pp. 15-19.