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EFFECT OF GROWTH OF REGULATOR ON *THAUMATOCOCUCUS DANIELLII* BENTH

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ABSTRACT: This study was conducted to determine the efficient level of growth regulator best suitable for the growth performance of *T. daniellii* rhizomes. The samples were concentrations of growth regulator mixed with 2kg of topsoil at different ratios as treatments. Eight (5) treatments included: varied concentrations of Indol-3-L butyric acid (0ml, 0.2ml, 0.4ml, 0.6ml and 0.8ml) + 2kg soil. The treatments were replicated five (5) times and laid out in a Completely Randomized Design (CRD). Parameters assessed were plant height, stem diameter, number of leaves root length, and leaf area of the seedlings. The data collected were subjected to Analysis of Variance (ANOVA) and means were separated using Duncan Multiple Range Test (DMRT) at 5% significance level. The result showed a significant difference among the treatments at 5% probability level except in plant height. It can be concluded that adding 0.4ml Indol-3-ylbutyric acid is most suitable for *T. daniellii* rhizomes and is recommended for better producing healthy and vigorous seedlings.

INTRODUCTION: Nigeria's forests form an integral part of the rural economy, providing subsistence goods and services as well as items of trade. Forest goods other than extracted timber are collectively referred to as non-timber forest products (NTFPs). Over the years NTFPs have emerged to take their place among the many aspects of forest use that guide natural resource decision-makers and have mooted as a potential alternatives to deforestation and land conservation activities because of the strong market value of some NTFPs.

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As a result, long-term value from the harvest of these products could override the short-term gain of converting forests or individual trees to other uses such as timber, agriculture or plantations. As Also, the gathering, processing and trading in forest NTFPs provide a good source of supplementary income for many households (Falconer 1990; [4, 5] Falconer, 1992 and Sunderland *et al*., 2004) [11]. *Thaumatococcus daniellii* (Miraculous berry), a perennial herby plant that occurs in the wild, is a promising NTFPs whose economic potential has not been fully exploited in Nigeria.

It is a forest understorey herb and belongs to the family Maranthaceae in the Zingiberales order of monocotyledon plants. *Thaumatococcus daniellii* is a rhizomatous, perennial herb up to 3-3.5 m high. It is a rhizomatous seed plant found in tropical rainforests and coastal areas of West African countries.

In Nigeria, it is mostly found in the country's western region. Its common names include miracle fruit and the leaf known as "ewe eran'' in Nigeria's Yoruba-speaking areas. It has long, slender stalks that can grow up to two or three meters high, each bearing a single tough and ovate-elliptic leaf (up to 60 cm long and 40 cm wide) arise singly from each rhizome node. *T. daniellii* is also found in swampy areas or very wet soils, near water bodies, sandy soils and abandoned farm. Vegetative growth of *T. daniellii* is seasonal with flowering and subsequent fruit set. Main flowering occurs at the beginning of the rainy season but occasional flowering may arise before or after this main season. The duration from flowering opening to fruit ripening average about 13 weeks.

It is a plant species from Africa known for being the natural source of thaumatin; an intensely sweet protein that is of interest in the development of non-caloric sweeteners. It is at least 3000 times as sweet as sucrose (Amusa [2], N. A., and Ash aye, O. A., 2009). Thaumatin is a food additive generally recognized as Safe by the US Food and Drug Administration and has potential uses in manufacturing drugs, confectionaries and beverages (Abbiw D., 1990) [1]. It is not a carbohydrate, and thus can be ideal sweetener for diabetic people (Lim T. K., 2012). In Nigeria, the leaves are used for boiling foods such as bean puddings and for wrapping foods such as locust beans, pounded yam and pap. Despite several benefits obtained from the plant's component parts, it has suffered unwarranted neglect in research development and growth improvement. Therefore this study specifically aims to evaluate the effect of hormone with four different concentrations on the growth of *T. daniellii* to determine which is best suited for it.

Plant growth regulators refer to artificially produced substances that, in very low quantities, normally act at sites other than the place of production and control different physiological processes that modulate plant growth and development. It is a structurally unrelated collection of small molecules derived from various essential metabolic pathways (Santner *et al.*, 2009; [10] Davies, 2010) [3]. These compounds are important plant growth regulators and mediate responses to biotic and abiotic stresses.

Plant hormones play central roles in the ability of plants to adapt to changing environments by mediating growth, development, nutrient allocation, and source/sink transitions (Peleg and Blumwald 2011) [9]. Although, Abscisic acid (ABA) is the most studied stress-responsive hormone, the role of Indol-3-ylbutyric acid (IBA) during environmental stress is less studied. Indol-3-ylbutyric acid (IBA) identified one active growth-promoting substance as abscisic acid (ABA). Therefore this study specifically aims to evaluate the effect of the hormone with four different concentrations on the growth of *T. daniellii* to determine which is best suitable for its growth.

MATERIALS AND METHODS:

Study Area: The experiment was carried out at the screen house of Federal College of Forestry, Ibadan. The College is located at Jericho area of Ibadan North West Local Government area of Oyo State, The area is on latitude 7°26'N and longitude 3°54'E of the Greenwich meridian. Its annual rainfall is about 1400 - 1500mm while the average temperature is 31.8°C. The average relative humidity is 65% (FRIN, 2014).

Procurement of Materials: *Thaumatococcus daniellii* rhizome was found in Oni-gambari Forest Reserve, Oyo State and samples were brought to Forest Herbarium, Ibadan (FHI) for identification. Topsoil (sandy-loam) was collected from FRIN, sieved with 5mm aperture iron sieve, sterilized in a sterilization chamber at 121^{o}C for 1 hour 30 minutes, and allowed to stay for 2 days before use. The rhizomes were cut with a sharp knife and the cut ends were allowed to remain underwater to minimize transpiration and water loss. They were directly planted into the polythene pots, and twenty uniformly growing seedlings were selected after two weeks of germination The growth regulators Indole-3-butyric acid (IBA) used had 4 levels of concentrations as follows:

T_1 - 2 kg of topsoil as control

T_2- 0.2ml of IBA + 2 kg of topsoil

T_3 - 0.4ml of IBA + 2 kg of topsoil

T_4 - 0.6ml of IBA + 2 kg of topsoil

T_5 - 0.8ml of IBA + 2 kg of topsoil

Data Collection and Analysis: *Thaumatococcus daniellii* seedlings under each treatment were used to monitor growth characteristics. Growth characteristics such as Total height (cm), Collar diameter (mm), Leaf production, Root length, and Leaf area (cm^3) where taken every week and lasted for nine (9) weeks. The data were then subjected to one-way variance analysis to compare the different treatments' effect on the early growth characteristics of *T. daniellii* seedlings. Means were separated using Duncan Multiple Range Test (DMRT) procedure. Results were summarized in tables.

Soil Analysis:

TABLE 1: LABORATORY ANALYSIS OF THE SOIL USED FOR THE EXPERIMENT

Parameter	Topsoil
PH (H_2O)	5.54
O.C%	9.53
O.M%	1.86
N%	1.03
%SAND	768
%CLAY	144
%SILT	88
P mg/kg	2.95
Ca (mol/kg)	2.20
Mg (mol/kg)	0.21
Na (mol/kg)	1.67
ECEC (mol/kg)	4.62
Zn	155
K	0.40
Mn	77
Exchangeable Acid	0.14
Texture Class	Sandy Loam

RESULTS AND DISCUSSION:

Results: Effect of growth regulators on the growth of *Thaumatococcus daniellii* Seedlings.

The result of ANOVA below revealed a significant difference ($p>0.05$) in the effect of growth regulators on the mean height, collar diameter, leaf production, leaf area and root length of *T. daniellii* seedlings **Table 3**.

However, mean values showed that the height of the seedlings grown with 0.4ml was the highest with 15.72cm, while the height of the seedlings grown with 0.8ml gave the lowest with 5.59cm.

In case of collar diameter, mean values showed that collar diameter of the seedlings grown with 0.4ml had the highest with 0.30mm while the collar diameter of the seedlings grown with 0.8ml gave the lowest with 0.14mm.

Moreover, mean values showed that leaves produced by the seedlings grown with 0.4ml gave the highest with 3.16 leaves while the leaves produced by seedlings grown with 0.2ml gave the least with 1.66 leaves of seedlings.

Similarly, under 0.4ml gave the highest leaf area of 89.58cm^3 while 0.8ml gave the lowest leaf area of 41.80cm^3. And also, 0.4ml gave the highest root length of 0.6cm while 0.8ml gave the lowest root length of 18.00 cm **Table 2.**

TABLE 2: MEAN EFFECT OF ORGANIC FERTILIZERS ON HEIGHT, COLLAR DIAMETER, LEAF PRODUCTION, ROOT LENGTH AND LEAF AREA OF *THAUMATOCOCCUS DANIELLII* SEEDLINGS

Treatment	Height	Collar diameter	Leaf production	Leaf area	Root length
T_1	13.78	0.22	2.13	75.93	25.35
T_2	6.96	0.15	1.66	46.40	24.40
T_3	15.72	0.30	3.16	89.58	40.40
T_4	9.16	0.20	2.00	85.97	22.25
T_5	5.59	0.14	2.16	41.80	18.00

TABLE 3: ANALYSIS OF VARIANCE FOR HEIGHT, STEM DIAMETER, LEAF PRODUCTION ROOT LENGTH AND LEAF AREA OF *THAUMATOCOCCUS DANIELLII* SEEDLINGS

		Height	Stem	Leaf	Leaf area	Root length
Sources of Variation	Df	P-Value	Diameter P-Value	production P-Value	P-Value	P-Value
Treatment	5	3.9812*	0.0007*	0.0017*	1.4510*	00715*
Error	15					
Total	20					

*= significantly different, ^{ns}= not significantly different

DISCUSSION: Seedlings can utilize varied concentrations of growth regulators to grow; therefore, accessibility for seedlings of high vigor are vital features suitable for establishing plants in the nursery. It was stated by Rolfe in 2005 [8] that plant regulators are not nutrients but chemicals that,

in small amount promote and influence the growth, development, and differentiation of cells and tissues. And so, growth regulator requirements of species differ, so effort must be made to identify the appropriate quantity of growth regulator. The result revealed that all the growth characteristics of *T. daniellii* seedlings performed best in the 0.4ml amount of growth regulator as it recorded highest in the collar diameter, leaf production root length and leaf area of the seedlings. This study is in correlation with the findings of Yao (2010) [12], who reported that Indol-3-ylbutyric acid promotes plant division and growth. And farmers use it to increase crops as it has been found that applying to cotton seedlings led to a 5-10% yield increase under drought conditions. Osborne and McManus in 2005 [7] reported that, control of stem, root, and fruit, convert stem into flowers affecting cell elongation by altering cell wall stability. These findings were in agreement with Hettasch *et al.* (2009) [6] who applied IBA plant regulator in the powdery form at 8g kg-1 on *Pinus elliottii* and *Pinuscaribaea* cuttings, and recorded 90% rooting with an increase in quantity and quality of roots produced.

CONCLUSION: The result obtained from this study reveals that *T. daniellii* rhizomes responded fairly well to the growth regulator. Optimum performance in terms of all the parameters were obtained from the concentration of 0.4mlIndol-3-ylbutyric acid. In view of this, it can be concluded that, though *T. daniellii* showed a response to different levels of the growth regulator causing unlimited growth and development of the rhizomes, but addition of 0.4mlIndol-3-ylbutyric acid is most suitable for *T. daniellii* rhizomes and is recommended for better produce healthy and vigorous seedlings.

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