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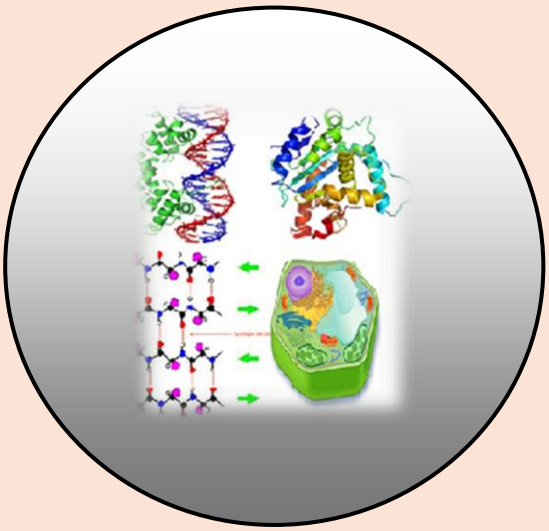

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Growth and Yield of *Thaumatococcus daniellii as* Affected by Shade Levels

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ABSTRACT

A pot experiment was conducted at the National Horticultural Research Institute (NIHORT), Ibadan between October 2011 to April 2012 to investigate the effect of shade on Thaumatococcus daniellii and determine the optimum amount of light requirement for growth of Thaumatococcus daniellii.

The experiment was arranged in randomized complete block design (RCBD) with three replicates. Shades levels of 30%, 45% and 65% were created by draping a black polyethylene shade net over a wooden frame 70cm above the plants. A single, double and quadruple fold produced 30% shade, 45% shade, 65% shade. Plot which had no net (full sunlight) served as control.

Shading significantly increased the Number of leaves, leaf area, root length and total dry weight. Intense shade at 65% produced the most number of leaves and the largest leaf area while 0% shade produced the least number of leaves and least leaf area.45% shade produced the longest roots while the 0% (full sunlight) produced the shortest roots. 45% shade produced the largest total dry weight while 0% (full sunlight) produced the smallest total dry weight. 45% shade was significantly different from 0% shade. Hence, this study show that 45% shade was optimum for growth of T. daniellii when compared with 0%, 30% and 65% shade levels. For leaf production however, 65% shade level is optimum suggesting that 65% shade should be adopted for leaf production.

Keywords: Thaumatococcus daniellii, Growth, Randomized Complete Block Design (RCBD) and Shade Level.

INTRODUCTION

Thaumatococcus daniellii (Benth) commonly referred to as the sweet prayer plant or miraculous berry is a non-timber tropical forest product which belongs to the family Maranthaceae. It has long slender stalks, reaching heights of about 2-3meters. The stalk terminates into a single tough, almost round and versatile leaf of varying sizes depending on the age and habitat of the plant (Makinde and Taiwo, 2004). It is a multipurpose perennial herb that offers a wide range of uses with its leaves, fruits, stalks and rhizomes from cultivation as fetish plant in Gabon (Mansfeld, 1986) to collecting leaves from its natural habit for wrapping and boiling food in Ghana and Nigeria such as pounded yam, bean pudding [moinmoin] etc. (Facciola 1998). The leaves are also used for preserving kola nuts and as food supplement to some ruminant including goat. The stalk is used for the weaving of (mat, fish traps and ornamental bag) as sponge and for pulping roll. The root is used in traditional medicine. It has been domesticated in most parts of South Western Nigeria, where it contributes to the economy of the rural population (Osemeobo, 2005).*T. daniellii* propagates itself by rhizomes depending on the environment of the plant. The long petioles ends in large, broad and oval papery leaves which are ovate –entopic rounded, truncate at the base and shortly accumulate at apex. Consequent upon the discovery of "Thaumatin", a non-caloric sweetener derived from the arils of plants which is reportedly about 1600 times sweeter than sucrose, the plant gained global prominence (Zemanek and Wasserman, 1995). *T. daniellii* in cropping system or plantations may be a promising way to increase production, mitigate its extinction and contribute to both income generation and diversification of crop production by small farmers. The propagation protocols of *T. daniellii* have not been previously reported. Thus, this study was undertaken as part of the initiatives to restore *Thaumatococcus daniellii* by elucidation of protocol for its propagation. The specific objective was to determine the optimum amount of light requirement for growth of *Thaumatococcus daniellii.*

MATERIALS AND METHOD

Forty-eight leafy rhizomes of *Thaumatococcus danielli* were obtained from the germplasm maintained at the Floriculture Programme of National Horticultural Research Institute (NIHORT). The rhizomes were nursed for two weeks in perforated black polythene. The seedlings were then transplanted into buckets filled with 11kg of 2mm sieved top soil sampled from 0 – 20cm depth and mixed with sharp sand (10:1, v/v). The pre-cropping soil analysis is presented in Table 1.

The plants were subjected to 4 treatment levels consisting of different shade levels created by draping a black polythene shade net over a wooden frame 70cm above plants. Thus, a single, double and quadruple fold produced 30%, 45% and 65% shade levels respectively. A plot having no shade net over it served as the check plot (i.e. 0% shade level). The experiment was laid out in a randomized complete blocks design and replicated thrice.

Growth Conditions

Plants were grown for 6months in buckets under controlled conditions of 77 – 92% relative humidity and an average temperature of 25^0C. Seedlings were watered thrice a week. Light intensity was measured with a light sensor attached to CIRAS 1 porometer (PP Systems, CHC).

Data Collection and Statistical Analysis

Data were collected on leaf area, number of leaves and number of tillers - commenced four weeks after transplanting (4WAT) and subsequently at two weeks interval until the experiment was terminated. Number of root, root length, shoot dry weight were determined at the end of the experiment. Leaf area was determined non-destructively by measuring the length and then using the regression equation below to derive the leaf area.

$Y = 15.24X - 82.35$

$r^2 = 0.75$

Where Y = leaf area (cm^2/plant)

X = lamina length (cm/plant)

r^2 = regression coefficient

A two-way analysis of variance was carried out on the data collected using the Statistical Analysis Software (SAS Institute, 2001).

Table 1. Pre-cropping Characteristic of the Soil Used.

Properties	**Soil value**
%sand	75.52
%silt	10.56
%clay	13.92
Chemical Composition	
PH	7.31
Organic Matter	5.14%
Available Phosphorus	84.06mg/kg
Total nitrogen	0.28%
Organic carbon	2.97%
Exchangeable bases	cmol/kg
Potassium	1.05
Sodium	0.84
Magnesium	2.58
Calcium	16.11

RESULTS

Number of leaves: as observed in Fig 1, intense shade at 65% produced the highest number of leaves while 0% shade produced the least number of leaves throughout the growth period. No significant differences were observed among the different shades level between 2 to 10WAT. However at 12-22WAT, number of leaves produced by plants under the 65% shade level was significantly higher to those under the 30% and 0% shade levels but not significantly different from shading. It was also observed that number of leaves did not increase progressively in no shading and this decline from 18WAT to 22WAT.

Leaf Area: Intense shade at 65% produced the largest leaf area per plant while 0% shade produced the least leaf area throughout the growth period. There was no significant effect of different shade levels at 2 and 4WAT.

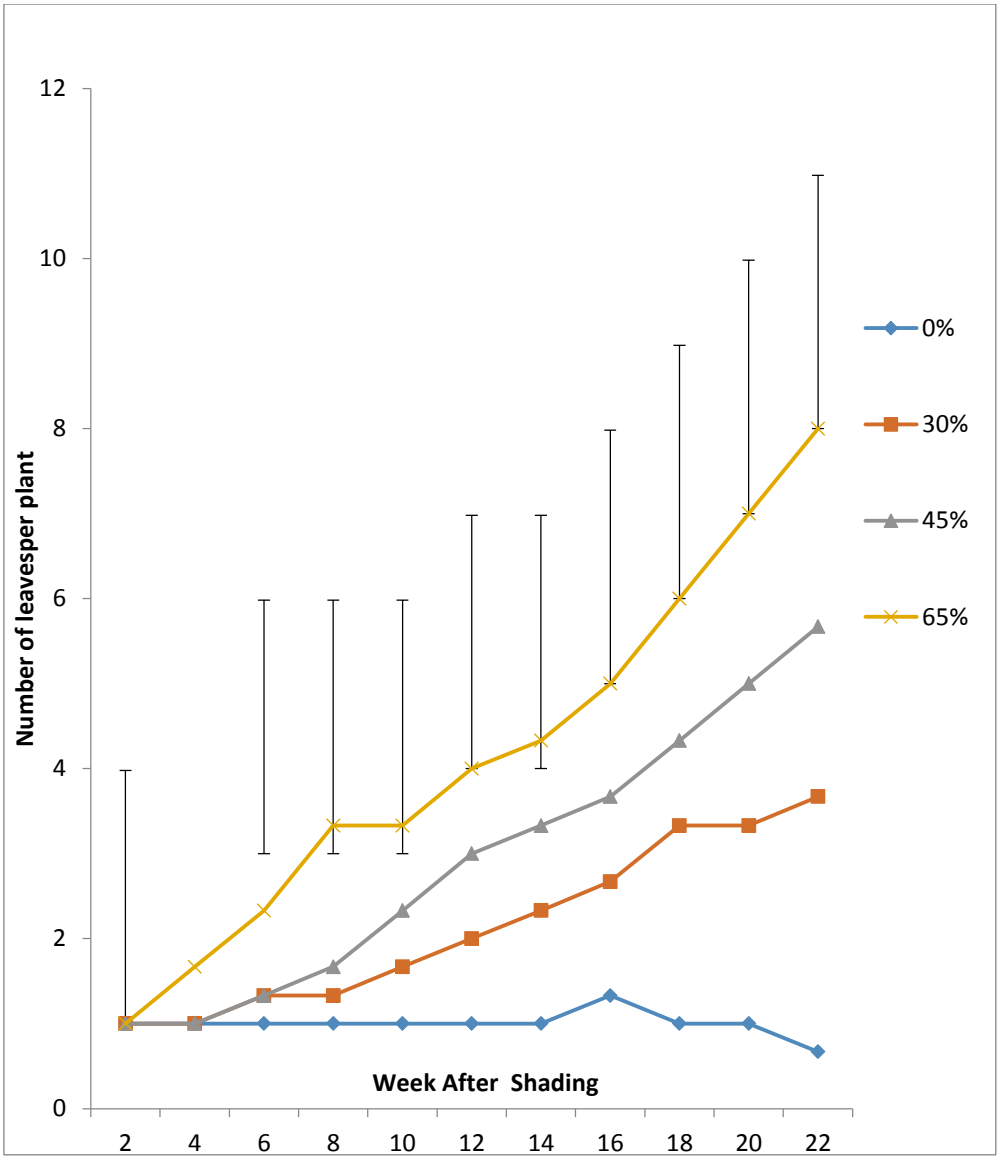

Figure 1. Effect of shade on number of leaves of *Thaumatococcus daniellii.*

Leaf area of plants under 0% shade level decreased from 16WAT till the end of the experiment. No significant differences were observed from 8-16WAT for plants under the 65%,45%and 30% shade levels, however, the leaf area of plants under the 65% shade level was significant higher than those under 0% shade levels. At 18WAT, leaf area of plants under 65% shade level was significantly larger than 30% and 0% while at 20-22WAT, leaf area of plants under the 65% shade level was not significantly different from 45% but significantly different from 30% and 0% (Fig 2).

Root Length: as seen in Table 2, the longest root length was produced in plants subjected to 45% shade level while the 0%shade (full sunlight) plants produced the lowest plant root length. There was no significant difference between 65%, 45%, 30% and 0%, but there was significant different between 45% and 0%shade at the end of the study.

Number of root: Table 2 shows that 45% shade produced the highest number of roots while the 0%shade (full sunlight) produced the lowest number of roots (Plate 2). There was no significant difference in the root number of plants in the different shade levels.

Dry Matter: Table 2 shows 45% shade level plants produced the highest total dry weight while those under the 0% shade (full sunlight) produced the least total dry weight. There was no significance different between 65%, 45%, 30% and 0%, but there was significant difference between 45% and 0%shade (full sunlight).

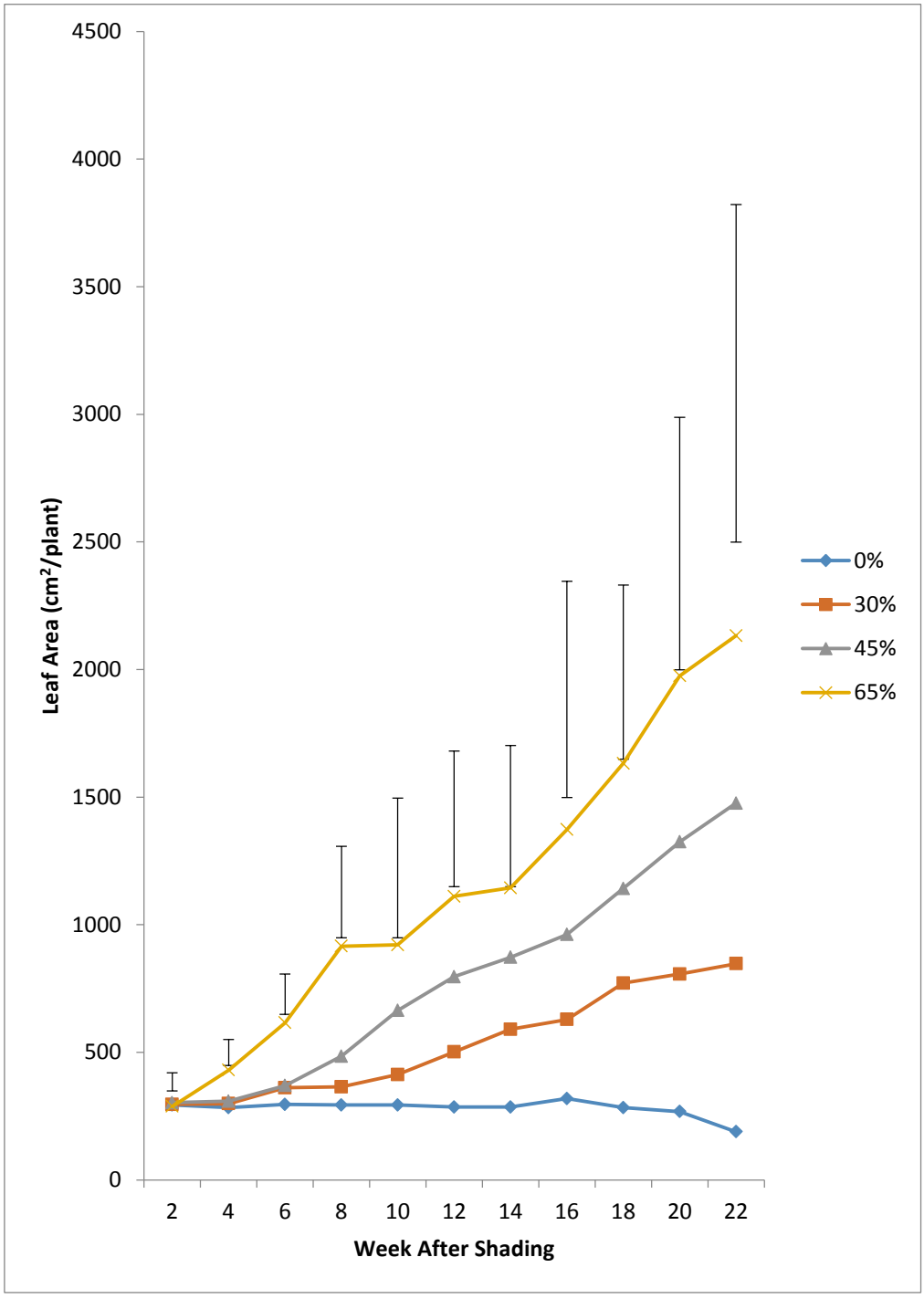

Figure 2. Effect of shade on leaf area of *Thaumatococcus daniellii.*

Table 2. Root characteristics, number of tillers, total fresh weight and total dry weight of *T. daniellii* across shade levels.

Shade	Root length(cm)	Number of roots	Number of tillers	Total fresh weight(g)	Total dry matter(g)
0%	19.00	20.00	1.00	12.48	5.56
30%	34.33	15.33	4.33	19.35	7.50
45%	48.67	34.33	6.33	49.70	17.13
65%	36.33	30.33	9.00	38.96	14.60
LSD(0.05)	20.97	21.24	6.00	29.37	10.59

0% **30%** **45%** **65%**

Plate 1. *Thaumatococcus daniellii* in response to varying shade levels at harvest.

DISCUSSION

The result of this study has shown that shading significantly contributes to the growth and dry matter weight of *T. daniellii*. *Thaumatococcus daniellii* with 65% and 45% shades had similar beneficial effect with better and plant height, number of leaf and leaf area, as well as well-developed root system but were significantly different plant impose with 30% and 0%. Wilson, (2000) suggested that shades cause a corresponding increase in the proportion of leaf and an increase in root ratio. Joana and Ryszard (1990) also suggested that shade improves the adaptability of the plant to decreased light intensity. Moreover, Modupeola (2020) reported that, higher radiation due to lower plant density in tomato increases the leaf area of tomato. However, the root system of *T. daniellii* under shade level of 45% was observed having longest root than 65% and 30% while 0% was observed having shortest roots, but 45% was significant different from 0% (ull light). This indicated that there is no direct correlation between the shoot and root system *Thaumatococcus daniellii* in response to shade. 45% shade produced the largest total dry weight while the 0% shade produced the shortest total dry weight. There was no significant difference between 65%, 45%, 30% and 0%, but 45% was significant different from 0% (full light).

CONCLUSION

Intense shade at 65% produced the most number of leaves and the largest leaf area while 0% shade produced the least number of leaves and least leaf area.45% shade produced the longest roots while the 0% (full sunlight) produced the shortest roots. 45% shade produced the largest total dry weight while 0% (full sunlight) produced the smallest total dry weight. 45% shade was significantly different from 0% shade.

Hence, this study shows that 45% shade was optimum for growth of *Thaumatococcus daniellii* when compared with 0%, 30% and 65% shade levels. In terms of leaves production however, 65% shade level is optimum which may be advantageous during harvesting as the farmer would not need to bend down too much. Possible areas of study could be to investigate and obtain varieties that can have both traits (high number of leaves per plant and large leaf area) combined while still retaining other traits.

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REFERENCES

Eichhorn, S.E., Evert, R.F. and Raven, P.H. (1999). Biology of plants. Freeman Company/Worth Publishers, USA, 6. Ed, pp 713-714.

Facciola, S. (1998). Cornucopia 2: A source book of edible plants. Kampung Publications, Vista (CA), USA, p. 149.

Johnson, J. (1997). Environmental/Biodiversity Implication of New Crops. In. J. Smartt and N. Haq (Editors).*Domestication, production and utilization new crop*. ODA. Colour Printers, Dhakar, Bangladesh, pp 46-48.

Makinde, S.C.O and Taiwo, C.K. (2004). *In situ* population evaluation of *Thaumatococcus danielli*(Benth). *ASSET International Journal*, B, (3) 1:75 –80.

Mansfeld, R. (1986). Directory agricultural and horticultural crops. *Springer*, Berlin2ndEd, pp. 1690-1691.

Modupeola, T.O. (2020). Impact of planting density on physiological growth and yield of tomato varieties in Rain- Forest Agro-Ecological zone of Nigeria. *Production Agriculture and Technology Journal* (PAT). ISSN: 0794-5213. Vol. 16 (2).Pg: 148-155.

Joanna, N. and Ryszard, M.R. (1990). *Postharvest handling and storage of cut flowers, floristgreens and potted plants.* Portland, Oregon: Timber Press.

Osemeobo, G. J. (2005). Living on wild plants: Evaluation of the rural household economy in Nigeria. *Environmental Practice* 7(4):246 – 256.

Zemanek B.P. and E.C. Wasserman (1995). Influence of P H on thermo-degradation of thaumatin in aqueous solution. *Food research international*; Elsevier science Ltd, *Great Britain* 30(9):707.

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