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Early Growth Performance of African Breadfruit (*Treculia africana* Decne) as Influenced by Shade and Fertilizer

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Abstract: *In an attempt to conserve and domesticate African breadfruit (Treculia africana Decne), a trial was conducted at the National Horticultural Research Institute (NIHORT), Ibadan Nigeria to document the growth requirement of this plant at the early growth stage under different shade regimes and inorganic fertilizer application. The breadfruit seedlings were transplanted at 4 weeks after germination in the pre-nursery into pots filled with 10kg of top soil. Four shade regimes (0, 25%, 50% and 75%) of black plastic net and four fertilizer levels (0, 100, 200 and 300kg/ha NPK 15:15:15) were used. The nursery trial was a 4 x 4 factorial laid out in a completely randomized design. The result revealed that there were significant effects of the shade regimes on the number of leaves, plant height and stem girth as from 50% shade treatment starting from 5 months after treatment application. The best fertilizer rate was 200kg/ha of NPK 15:15:15 giving the highest plant height and stem girth values. However, 50% shade regime combined with 100kg/ha NPK 15:15:15 gave the best early growth performance in African breadfruit.*

Keywords: *African breadfruit, shade, inorganic fertilizer*

INTRODUCTION

The African Breadfruit (*Treculia africana* Decne) is a member of the Miraceae family that includes the more popular Polynesian Breadfruit, *Artocarpus altilis* Fosberg (also called *Artocarpus cummunis*). The family contains over 50 genera and over 1000 species of tropical trees and shrubs, many of which produce edible fruits and seeds. The members of this family are much-branched trees, up to 20m high, inhabiting tropical wet coastal plains and well-drained soils. The trees bear large fleshy fruits which are covered with wart-like growths (Nwokolo, 1996). Breadfruit is a traditional food; the consumption is actually accepted and is gradually being changed from food for the poor to that of the affluent in all communities where it exists in tropical Africa. Okeke *et al.* (2008) confirmed its choice by the rich and the sick by describing it as an expensive delicacy eaten alone, boiled or eaten with other foods, and could be roasted and eaten with palm kernel or coconut as a snack.

The seeds when dried are highly nutritious containing 12.5% protein, 4.2% fat, 2.3% ash, 1.6% fiber and 73% carbohydrate. The African Breadfruit (*Treculia africana*) is filled with seeds, the plant being cultivated primarily for its delicious ellipsoidal seeds. Seed production from the African breadfruit is considerable, a mature tree producing up to 30 fruits annually, each fruit yielding 5-10kg of seed after processing. African breadfruit is an important natural resource for many in the region, contributing significantly to their income and dietary intake (Baiyeri and Mbah, 2006). In Nigeria and Cameroon, many rural dwellers are engaged in collection, processing and sale of *T. africana* as a means of livelihood. Due to its domestic and economic importance, the tree has been heavily exploited resulting in its highly endangered status (Onyekwelu and Fayose, 2007). To abate total loss or extinction of this important forest species, there is need to conserve them by cultivating them. Limited agronomic information has limited the widespread utilization and cultivation of the African breadfruit (Osuji and Owei, 2010). The seeded breadfruit is always grown from seeds, which must be planted when fairly fresh as they lose viability easily. Propagation from seed is inexpensive and usually effective, and therefore a viable method for their ex-situ conservation (Abirami *et al.,* 2010). This important plant is still found occurring in the forest among other trees where they grow luxuriously. In an attempt to evaluate and document the growth requirements of African breadfruit, this trial was conducted to assess the early growth performance of this plant as influenced by inorganic fertilizer and different shade regimes under tropical conditions.

MATERIALS AND METHODS

The trial was conducted at the National Horticultural Research Institute (NIHORT), Ibadan Nigeria. Mature fruits of African Breadfruit (*Treculia africana*) were collected from the indigenous fruits' orchard of NIHORT, Ibadan. These seeds were processed and air-dried for 24 hours. The seeds were then planted in nursery trays filled with well drained top soil. The seedlings were later transplanted into buckets filled with 10kg of top soil. The top soil was analyzed for physical and chemical properties prior to transplanting. Shades were constructed using plastic net to maintain evenness of shade. The light intensity under the shades was measured using a light meter and the readings obtained were used to allot percent shade regimes for the treatments. Treatments of four shade regimes (0, 25%, 50% and 75%) and four fertilizer rates 0, 100, 200 and 300kg/ha were imposed on the seedlings using NPK 15:15:15. The experiment was a 4 X 4 factorial design laid out in a completely randomized design with four replicates. Data collected include plant height, stem diameter and number of leaves. The analysis of the top soil used was also done prior to transplanting.

RESULTS

Soil Test Results

Pre-planting soil test revealed that the soil was high in macronutrient concentrations especially nitrogen (0.28%) and phosphorus (25.54mg/kg) but had low potassium concentrations (Table1). The soil also had moderate levels of organic matter (2.1%) and the soil texture was loamy sand.

Table 1: Laboratory test results of the top soil

Parameters	Test Values
1. pH (KCl)	5.6
2. pH (H_2O)	6.4
3. Organic Carbon (%)	1.2
4. Organic Matter (%)	2.1
5. Total Nitrogen (%)	0.28
6. Available Phosphorus (mg/kg)	25.54
7. Exchangeable Calcium (me/100g)	13.07
8. Exchangeable Magnesium (me/100g)	1.09
9. Exchangeable Sodium (me/100g)	0.31
10. Exchangeable Potassium (me/100g)	0.18
11. Exchangeable Acidity (me/100g)	0.4
12. Cation Exchange Capacity (me/100g)	15.05
13. Base Saturation (%)	97.34
14. Manganese (mg/kg)	90.1
15. Iron (mg/kg)	8.4
16. Copper (mg/kg)	1.2
17. Zinc (mg/kg)	6.7
18. Sand (%)	78.6
19. Silt (%)	15.4
20. Clay (%)	6.0
21. Texture	loamy sand
22. Bulk Density (gcm^{-3})	1.66

Effects of shade regimes on the growth parameters of *Treculia Africana*

The results showed that there were significant differences in the shade regimes on plant height at 3, 4, 5, 6 and 7 months after transplanting (MAT) with 75% shade regime recording the best plant height performance (Table 2). There was no significant effect of the shade regimes on stem girth at 3, 4, 5 and 7 MAT but significant differences were observed at 6 MAT (Table 3). The effect of the shade regimes on the number of leaves of the *Treculia africana* was significant at all levels of observation except at 3 MAT with the 50% shade regime giving the highest number of leaves.

Table 2: Effect of shade regimes on plant height (cm) of *Treculia africana* seedlings

SHADE REGIMES	3MAT	4MAT	5MAT	6MAT	7MAT
No Shade	24.90b	35.50b	48.13b	59.13c	64.38b
Shade 1 (25%)	26.10b	36.25b	51.75b	63.81bc	70.75b
Shade 2 (50%)	27.11b	36.69a	53.44b	70.94bc	83.44a
Shade 3 (75%)	**30.22a**	**43.94a**	**61.88a**	**76.25a**	**86.06a**
SE	0.93	1.30	2.05	3.19	3.98

MAT – months after transplanting

Table 3: Effect of shade regimes on stem girth (cm) of *Treculia africana* seedlings

SHADE REGIMES	3MAT	4MAT	5MAT	6MAT	7MAT
No Shade	6.24	7.90	10.71b	12.51b	14.71
Shade 1 (25%)	6.33	8.11	11.35ab	13.54ab	14.55
Shade 2 (50%)	6.30	8.18	**12.07a**	**14.39a**	**14.92**
Shade 3 (75%)	**6.80**	**8.53**	11.64ab	13.82ab	14.76
SE	0.25	0.27	0.40	0.47	0.49

MAT – months after transplanting

Table 4: Effect of shade regimes on number of leaves of *Treculia africana* seedlings

SHADE REGIMES	3MAT	4MAT	5MAT	6MAT	7MAT
No Shade	10.88b	12.13c	13.44c	14.19c	12.56c
Shade 1 (25%)	10.80b	12.56bc	14.13bc	16.25bc	15.75b
Shade 2 (50%)	**12.00a**	**14.38a**	**16.44a**	**19.13a**	**20.31a**
Shade 3 (75%)	11.70ab	13.75ab	15.38ab	18.00ab	18.44ab
SE	0.39	0.57	0.65	0.79	0.98

MAT – months after transplanting

Effects of NPK (15:15:15) fertilizer on the early growth performance of *Treculia Africana*

The effect of the application of inorganic fertilizer, NPK 15:15:15, was not significant on plant height at 3, 4, 5, 6 and 7 MAT (Table 5). The same trend was observed for the stem girth (Table 6) while there was significant effect of the fertilizer on the number of leaves at 6 and 7 MAT (Table 7).

Table 5: Effect of inorganic fertilizer on plant height (cm) of *Treculia africana* seedlings

NPK (15:15:15)	3MAT	4MAT	5MAT	6MAT	7MAT
Control	26.46ab	37.19	51.69	64.09	73.94
100kg/ha	28.16ab	38.31	54.88	69.84	77.44
200kg/ha	**28.21a**	**38.38**	**55.13**	**70.19**	**80.31**
300kg/ha	25.51b	36.50	53.50	66.00	72.94
SE	0.93	1.30	2.05	3.19	3.98

MAT – months after transplanting

Table 6: Effect of inorganic fertilizer on stem girth (cm) of *Treculia africana* seedlings

NPK (15:15:15)	3MAT	4MAT	5MAT	6MAT	7MAT
Control	6.51	**8.73a**	11.59	13.48	15.11
100kg/ha	6.33	8.21ab	11.31	13.51	14.50
200kg/ha	**6.68**	8.10ab	**11.87**	**13.68**	**15.26**
300kg/ha	6.12	7.69b	11.00	13.59	14.08
SE	0.25	0.27	0.40	0.47	0.49

MAT – months after transplanting

Table 7: Effect of inorganic fertilizer on the number of leaves of *Treculia africana* seedlings

NPK (15:15:15)	3MAT	4MAT	5MAT	6MAT	7MAT
Control	10.88	**13.50**	14.00	15.63b	14.38b
100kg/ha	11.50	**13.50**	**15.63**	**18.06a**	17.81a
200kg/ha	**11.81**	12.88	15.19	18.00a	**18.31a**
300kg/ha	11.13	12.94	14.56	15.88ab	16.56ab
SE	0.39	0.57	0.65	0.79	0.98

MAT – months after transplanting

Effect of the interaction of shade regimes and fertilizer application on the growth parameters of *Treculia africana*

Significant effects of the interaction of shade and fertilizer was observed on plant height at 4 ($P<0.01$) and 5 ($P<0.05$) MAT while no significant (NS) effects were observed at 3, 6 and 7 MAT. No significant effect of the treatment interactions was observed on stem girth at 3 and 6 MAT but significant effects were noticed at 4, 5 and 7 MAT. No significant effects of the treatments were observed on number of leaves at all levels of observations. The results of the interaction between the shade regimes and inorganic fertilizer rates showed that the combination of 50% shade regime with 100kg/ha NPK 15:15:15 gave the best growth performance with regards to plant height and number of leaves (Table 8). No shade regime combined with no fertilizer application recorded the best stem girth growth indicating that the treatments had no positive effect on the stem girth growth parameter.

Table 8: Effect of shade regimes and fertilizer levels on the growth parameters of *Treculia africana* seedlings at 7 months after transplanting

%Shade	**Fertilizer (kg/ha)**	**Plant Height (cm)**	**Stem Girth (cm)**	**Number of Leaves**
	(NPK 15:15:15)			
0	0	76. 50	**17.60**	12.25
0	100	54.75	12.33	10.50
0	200	61.75	14.13	13.00
1	300	64.50	14.80	14.50
25	0	67.00	14.80	13.75
25	100	75.75	15.33	18.25
25	200	79.75	16.03	15.50
25	300	60.50	12.05	15.50
50	0	67.25	14.03	17.25
50	**100**	**98.25**	15.38	**24.50**
50	200	83.25	15.45	22.50
50	300	85.00	14.83	17.00
75	0	85.00	14.00	14.25
75	100	81.00	14.98	18.00
75	200	96.50	15.48	22.25
75	300	81.75	14.63	19.25
LSD		7.97	0.99	1.96

CONCLUSION

Treculia africana under nursery conditions performed at the optimal growth level with 75% shade regime while 200kg/ha of NPK 15:15:15 gave the highest plant height and stem girth. The combination of 50% shade regime with 100kg/ha NPK 15:15:15 gave the best early growth performance (plant height and number of leaves). Therefore, 50% shade regime combined with 100kg/ha NPK 15:15:15 is recommended for optimal growth performance of African Breadfruit (*Treculia africana*) under tropical nursery conditions

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