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Effects of Different Growth Hormones on Seed Germination and Seedling Growth of African Locust Bean *(Parkia biglobos*a(Jacq) Benth)

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Abstract: *Timber and non-timber tree species medicinal properties often suffer from extensive exploitation. In order not to allow these species to go into extinction there is a need for rapid replacement. A study was carried out in Anyigba, Dekina local government of Nigeria to investigate the effect of different growth hormones viz: Acetic acid (AA) and Butyric acid (BA) on seed germination and seedling growth of Parkia biglobosa (JACQ) Benth. The experiment was carried out using the growth hormones at different rate of concentration (0%, 10%, 20% and 30%) respectively. It is a pot experiment carried out in a Completely Randomized Design (CRD) with eight treatments and four replications. The parameters measured were subjected to analysis of variance (ANOVA). The means were separated by Least Significance Difference (LSD ≥ p0.05). The result showed that the performance of Parkia biglobosa can be raised without treating the seeds with growth hormones.*

Keywords: *Growth hormones, Effects, Parkia biglobosa, Nigeria*.

1. INTRODUCTION

African locust bean (*Parkia bigIobosa* (Jacq) Benth) is a member of the leguminoseae family. It belongs to the sub-family mimosoideae. The tree is a 7-20 m tall perennial deciduous tree named *Parkia bigIobosa* after Mungo Park, scot who made two remarkable journey of exploration into the interior of West Africa (Adewumi and lgbeka, 1993; Audu *et al.,* 2004). The multipurpose tree has seeds with a hard testa and these seeds are large with a mean weight of about 0.3 g/seeds embedded in a yellow pericarp and the colour of these pods change from pink brown to dark brown as maturity sets in. The tree also bears alternate, dark green bipinate leaves and hermaphrodite flowers. The seeds are brown-blackish. Each seed has a 0.5-1 cm panicle, spherical-ovoid and slightly compressed laterally. The testa is hard, smooth glossy. Seed size varies within pod, with those at the centre being largest. It is widely used for its remarkable nutritional value and the dietary value it contains. The seeds are known to be rich in protein 30- 40%, oil 31-40%, carbohydrate 11.7-15.4%, crude fibre 8.82-94%, Iipids 54%, minerals and vitamin B2 such as calcium, potassium and phosphorus and when fermented are rich in lysine (Aliero *et al.,* 2004 and Campbell-platt, 1980). The fat in the beans is nutritionally useful (approximately 60% unsaturated). The seeds which are particularly valued for their high proteins are fermented for cooking. The embedding yellow pulp of the seed sometimes called dozim which have a high energy value is used as a sweetner as it contains 60% sugar (Audu *et al*., 2004). The embedding yellow pulp of the seed is also supposedly water purified and is taken for fevers. The fruit is a source of food during drought. The leaves are edible and sometimes mixed with cereals and are added in lotions for sore eye burns, haemorrhoids and toothache. Medicinally, the bark is used as a mouthwash and also macerated in baths to cure leprosy. It is also used for a wide range of ailments such as malaria, diarrhea, jaundice and so on (Audu *et al.,* 2004). The locust bean occurs in a diversity of agro-ecological zones, ranging from tropical forest with high rainfall to arid zones, from lower Sudan savanna southwards to the derived savanna and the lowland forest where mean annual rainfall may be less than 400 mm (Gbadamosi, 2005). Since it has been discovered that *Parkia biglobosa* possesses an exogenous dormancy in which the hard seed coat prevent it's germination (Hall *et al.,* 1997) then, it is necessary to know the effect of growth hormones on seed germination and seedling growth of *Parkia biglobosa*.

2. MATERIALS AND METHODS

Experimental Site

The experiment was conducted in an open field in front of the green house at the Faculty of Agriculture, Kogi State University, Anyigba. The location is at (latitude$7^0 6^1$N and longitude $7^0 43^1$E) fall within the southern guinea savanna zone of Nigeria. The area falls within tropical wet and dry climate region and the guinea savanna with average annual rainfall. The daily temperature range is about 25^{0c}-35^{0c}.

Kogi State has a bimodal rainfall with the peak pattern occurring in July and September. The mean rainfall ranges from 1, 56 mm at Kabba in West to 1,808 mm at Anyigba in the East (Amhakhian *et al.*, 2012). The temperature shows some variation throughout the years. Average monthly temperature varies from 17^{0c} to $36{:}2^{0c}$ relative humidity is moderately high and varies from an average of 65-85% throughout the year (Amhakhian *et al.*, 2012).

Experimental Design and Source of Material

The experiment was a pot experiment carried out in a Completely Randomized Design (CRD) with eight treatments and four replications. This gives a total of 32 pots. The treatments consist of three different levels of Acetic acid and Butyric acid growth hormones and controls (no treatment) for both hormones. The seeds of *Parkia biglobosa* were gotten from Agricultural Development Project (ADP), while the growth hormones (Acetic acid and Butyric acid) was gotten from College of Health Sciences, Kogi State University, Anyigba.

Different rates of growth hormones, Acetic Acid (AA) and Butyric Acid (BA) at 30%, 20%, 10% and 0% respectively was diluted with 100 ml of distilled water. The seed of *Parkia biglobosa* was soaked for 24 hours thereafter; the seeds were soaked in the various rates of the two growth hormones and the water without dilution serving as control for five minutes, removed and planted immediately inside the plastic pots. All the treatments were watered daily for 12 weeks and the parameter readings was taken at two weeks interval till the end of the pot experiment.

Data Collection

The growth parameters that were taken are as follows;

1. Number of leaves per plant determined by direct counting of leaves on the plants.
2. Plant height determined by measuring the length of the plant from the base to the top where the newly developed leaves started using a meter rule
3. Stem Diameter determined by measuring the thickness of the plant stem with the aid of a thread and placed on a meter rule.
4. Number of branches per plant determined by counting the branches of the stem.

Data Analysis

All data collected was subjected to analysis of variance (ANOVA) as described by Snedecor and Cochran (1967) for completely randomized design (CRD and least significance difference (LSD) test were used to estimate the differences among treatment means.

3. RESULT AND DISCUSSION

Number of Leaves per Branch

The number of leaves per branch was observed not to be significant ($p>0.05$) at two weeks after planting. However, treatment 0% AA gave the highest number of leaves per branch (18.75) while treatment 20% AA recorded the least number of leaves per branch (16.25) (Table 1).

The number of leaves per branch was observed not to be significant ($p>0.05$) at four weeks after planting. However, treatment 20% BA gave the highest number of leaves per branch (19.75) while treatment 10% AA recorded the least number of leaves per branch (17.75) (Table 1).

The number of leaves per branch was observed to be significant ($p<0.05$) at Six weeks after planting. However, treatment 30% AA gave the highest number of leaves per branch (22.00), while treatment 20% BA recorded the least number of leaves per branch (16.75) (Table 1).

The number of leaves per branch was observed not to be significant (p>0.05) at eight weeks after planting. However, treatment 30% AA gave the highest number of leaves per branch (23.50), while treatment 20% BA recorded the least number of leaves per branch (20.50) (Table 1).

The number of leaves per branch was observed not to be significant (p>0.05) at ten weeks after planting. However, treatment 30% AA gave the highest number of leaves per branch (24.50) while treatment 10% BA recorded the least number of leaves per branch (21.25) (Table 1).

The number of leaves per branch was observed not to be significant (p>0.05) at twelve weeks after planting. However, treatment 20% BA gave the highest number of leaves per branch (26.00) while treatment 0% AA recorded the least number of leaves per branch (21.50) (Table 1).

Plant Height

The height of the plant was observed not to be significant (p>0.05) at two weeks after planting. However, treatment 0% BA gave the highest plant height (3.075 cm) while treatment 10% BA recorded the least plant height (1.875) (Table 2).

The height of the plant was observed not to be significant (p>0.05) at four weeks after planting. However, treatment 0% BA gave the highest plant height (3.275) while treatment 10% TA recorded the least plant height (2.525) (Table 2).

The height of the plant was observed not to be significant (p>0.05) at six weeks after planting. However, treatment 30% AA gave the highest plant height (5.755) while treatment 10% BA recorded the least plant height (4.475) (Table 2).

The height of the plant was observed not to be significant (p>0.05) at eight weeks after planting. However, treatment 30% AA gave the tallest plant height (7.375) while treatment 20% AA recorded the least plant height (5.525) (Table 2).

The height of the plant was observed not to be significant (p>0.05) at ten weeks after planting. However, treatment 30% AA gave the highest plant height (8.425) while treatment 20%AA recorded the least plant height (6.500) (Table 2).

The height of the plant was observed not to be significant (p>0.05) at twelve weeks after planting. However, treatment 10% BA gave the highest plant height (9.375) while treatment 0% AA recorded the lest plant height (6.600) (Table 2).

Stem Diameter per Plant

The stem diameter of the plant was observed not to be significant (P>0.05) at two weeks after planting. However, treatment 0% AA gave the highest stem diameter (0.900) while treatment 30% BA recorded the least (0.525) (Table 3).

The stem diameter of the plant was observed not to be significant (P>0.05) at four weeks after planting. However, treatment 20% BA gave the highest stem diameter (1.175) while treatment 0% BA recorded the least (0.875) (Table 3).

The stem diameter of the plant was observed not to be significant (P>0.05) at six weeks after planting. However, treatment 30% BA gave the highest stem diameter (1.200) while treatment 10% AA recorded the least (1.050) (Table 3).

The stem diameter of the plant was observed not to be significant (P>0.05) at eight weeks after planting. However, treatment 30% BA gave the highest stem diameter (1.300) while treatment 0% AA recorded the least (1.225) (Table 3).

The stem diameter of the plant was observed not to be significant (P>0.05) at ten weeks after planting. However, treatment 30% BA gave the highest stem diameter (1.375) while treatment 20% BA recorded the least (1.225) (Table 3).

The stem diameter of the plant was observed not to be significant (P>0.05) at twelve weeks after planting. However, treatment 30% BA gave the highest stem diameter (1.525) while treatment 20%AA recorded the least (1.250) (Table 3).

Number of Branches per Plant

The number of branches per plant was observed not to be significant (P>0.05) at two weeks after planting. However, treatment 0% BA gave the highest number of branches (8.50) while treatment 30% BA recorded the least number of branches (4.25) (Table 4).

The number of branches per plant was observed not to be significant (P>0.05) at four weeks after planting. However, treatment 20% BA gave the highest number of branches (11.50) while treatment 10% BA recorded the least number of branches (8.75) (Table 4).

The number of branches per plant was observed not to be significant (P>0.05) at six weeks after planting. However, treatment 20% BA gave the highest number of branches (15.50) while treatment 0% AA, recorded the least number of branches (10.00) (Table 4).

The number of branches per plant was observed not to be significant (P>0.05) at eight weeks after planting. However, treatment 20% BA gave the highest number of branches (19.00) while treatment 0% AA recorded the least number of branches (11.25) (Table 4).

The number of branches per plant was observed not to be significant (P>0.05) at ten weeks after planting. However, treatment 30% AA gave the highest number of branches (21.50) while treatment 30% BA recorded the least number of branches (18.25) (Table 4).

The number of branches per plant was observed not to be significant (P>0.05) at twelve weeks after planting. However, treatment 10% BA gave the highest number of branches (28.00) while treatment 0% AA recorded the least number of branches (15.50) (Table 4).

Table 1. *Effect of different growth hormones on number of leaves per branch per plant at 2, 4, 6, 8, 10 and 12 weeks after planting*

Treatment	2	4	6	8	10	12
0%BA	16.75	18.50	17.75[b]	22.00	23.50	24.50
10%BA	18.00	19.00	17.50[b]	22.00	21.25	22.50
20%BA	17.50	19.75	16.75[b]	20.50	22.50	26.00
30%BA	17.25	17.75	18.25[ab]	21.50	24.25	24.00
0%AA	18.75	17.75	19.25[ab]	20.22	21.50	21.50
10%AA	17.75	17.75	19.25[ab]	20.50	21.50	24.00
20%AA	16.25	19.00	19.50[ab]	20.50	21.50	21.50
30%AA	17.25	17.75	22.00[a]	23.50	24.50	23.00
LSD(5%)	--	--	3.92	--	--	--
CV (%)	12.14	13.57	9.58	112.94	12.32	50.73

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Table 2. *Effect of different growth hormones on plant height (cm) per plant at 2, 4, 6, 8, 10 and 12 weeks after planting*

Treatment	2	4	6	8	10	12
0%BA	3.075	3.275	5.450	6.500	7.825	8.775
10%BA	1.875	2.525	4.475	6.500	7.925	9.375
20%BA	1.925	3.075	5.050	6.775	8.025	9.300
30%BA	2.000	2.825	4.800	6.500	7.375	8.300
0%AA	1.925	2.750	5.100	5.775	5.850	6.600
10%AA	2.300	2.600	5.375	6.300	7.100	8.850
20%AA	2.225	2.575	4.925	5.525	6.500	6.925
30%AA	3.00	3.150	5.775	7.375	8.425	8.825
LSD (5%)	--	--	--	--	--	--
CV (%)	30.94	14.47	21.04	22.57	17.70	17.65

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Table 3: *Effect of different growth hormones on stem diameter (cm) per plant at 2, 4, 6, 8, 10 and 12 weeks after planting*

Treatment	2	4	6	8	10	12
0%BA	0.825	0.875	1.075	1.250	1.325	1.400
10%BA	0.575	1.100	1.125	1.275	1.325	1.500
20%BA	0.825	1.175	1.150	1.150	1.225	1.300
30%BA	0.525	1.025	1.200	1.300	1.375	1.525
0%AA	0.850	1.050	1.150	1.225	1.325	1.325
10%AA	0.900	0.975	1.050	1.225	1.300	1.300
20%AA	0.850	0.900	1.175	1.175	1.225	1.250
30%AA	0.800	1.150	1.200	1.225	1.375	1.475
LSD (5%)	--	--	--	--	--	--
CV (%)	22.53	20.32	16.15	79.22	13.12	12.76

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Table 4: *Effect of different growth hormones on number of branches per plant at 2, 4, 6, 8, 10 and 12 weeks after planting*

Treatment	2	4	6	8	10	12
0%BA	8.50	9.75	14.50	17.25	19.50	25.00
10%BA	4.75	8.75	13.50	18.00	19.75	28.00
20%BA	8.25	11.50	15.50	19.00	19.00	26.50
30%BA	4.25	10.00	13.00	17.00	18.25	22.25
0%AA	7.25	10.50	10.00	11.25	13.50	15.50
10%AA	7.50	10.75	13.50	15.50	18.50	22.00
20%AA	7.00	9.75	13.50	14.75	18.75	18.25
30%AA	8.00	10.00	12.50	17.75	21.50	22.00
LSD (5%)	--	--	--	--	--	--
CV (%)	36.65	21.81	21.57	22.25	117.72	25.46

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Fresh weight of root

The fresh plant weight of root was found not to be significant (P>0.05) at one month after planting. However, treatment 0% BA gave the highest fresh root weight (0.5563) while 20% AA recorded the least fresh weight (0.3338) (Table 5).

The fresh plant weight of root was found not to be significant (P>0.05) at two months after planting. However, treatment 20% BA gave the highest fresh root weight (1.0063) while 10% AA recorded the least fresh weight (0.5258) (Table 5).

The fresh plant weight of root was found not to be significant (P>0.05) at three months after planting. However, treatment 20% BA gave the highest fresh root weight (2.2280) while 0% AA recorded the least fresh weight (1.0185) (Table 5).

Fresh weight of shoot

The fresh plant weight of shoot was found not to be significant (P>0.05) at one month after planting. However, treatment 20% BA gave the highest fresh shoot weight (0.4653) while treatment 10% BA recorded the least fresh shoot weight (0.2868) (Table 6).

The fresh plant weight of shoot was found not to be significant (P>0.05) at two month after planting. However, treatment 10% BA gave the highest fresh shoot weight (1.2218) while treatment 0% AA recorded the least fresh shoot weight (0.8715) (Table 6).

The fresh plant weight of shoot was found not to be significant (P>0.05) at three month after planting. However, treatment 20% BA gave the highest fresh shoot weight (3.0218) while treatment 0% AA recorded the least fresh shoot weight (1.6510) (Table 6).

Dry weight of root

The dry plant weight of root was found to be significant (P<0.05) at one month after planting. However, treatment 0% BA gave the highest dry root weight (0.1000) while treatment 20% AA of another replication recorded the least dry root weight (0.0678) (Table 7).

The dry plant weight of root was found not to be significant (P>0.05) at two months after planting. However, treatment 20% BA gave the highest dry root weight (0.2618) while treatment 10% AA recorded the least dry root weight (0.1033) (Table 7).

The dry plant weight of root was found not to be significant (P>0.05) at three months after planting. However, treatment 0% BA gave the highest dry root weight (0.7105) while treatment 0% AA recorded the least dry root weight (0.3893) (Table 7).

Dry weight of shoot

The dry plant weight of shoot was found not to be significant (P>0.05) at one month after planting. However, treatment 20% BA gave the highest dry shoot weight (0.1580) while treatment 10% BA of another replication recorded the least dry shoot weight (0.0583) (Table 8).

The dry plant weight of shoot was found not to be significant (P>0.05) at two months after planting. However, treatment 20% BA gave the highest dry shoot weight (1.6070) while treatment 30% AA of another replication recorded the least dry shoot weight (0.2668) (Table 8).

The dry plant weight of shoot was found not to be significant (P>0.05) at three month after planting. However, treatment 20% BA gave the highest dry shoot weight (2.2835) while treatment 0%AA of another replication recorded the least dry shoot weight (1.0355) (Table 8).

Table 5: *Effect of different growth hormones on fresh root weight per plant at 1, 2, and 3 months after planting*

Treatment	1	2	3
0%BA	0.5563	0.9505	2.1173
10%BA	0.4423	0.7065	1.5183
20%BA	0.4120	1.0063	2.2280
30%BA	0.4785	0.7410	1.6300
0%AA	0.3540	0.6188	1.0185
10%AA	0.4545	0.5258	1.9140
20%AA	0.3338	0.6303	1.7223
30%AA	0.3575	0.6718	1.5920
LSD (5%)	--	--	--
CV (%)	0.57	60.67	36.72

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Table 6: *Effect of different growth hormones on fresh shoot weight per plant at 1, 2, and 3 months after planting*

Treatment	1	2	3
0%BA	0.4538	1.1980	2.7525
10%BA	0.2868	1.2218	2.1973
20%BA	0.4653	1.6115	3.0218
30%BA	0.3290	1.4810	2.0843
0%AA	0.3070	0.8715	1.6510
10%AA	0.3683	1.0210	1.8785
20%AA	0.3023	0.9553	1.8733
30%AA	0.3908	1.1798	2.1450
LSD (5%)	--	--	--
CV (%)	48.15	37.17	41.50

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Table 7: *Effect of different growth hormones on dry root weight per plant at 1, 2, and 3 months after planting*

Treatment	1	2	3
0%BA	0.1000[a]	0.2423	0.7105
10%BA	0.0763[f]	0.1695	0.4453
20%BA	0.0820[e]	0.2618	0.7053
30%BA	0.0835[d]	0.1735	0.4955
0%AA	0.0703[g]	0.1068	0.3893
10%AA	0.0890[b]	0.1033	0.4430
20%AA	0.0678[h]	0.1443	0.5538
30%AA	0.0850[c]	0.1520	0.5260
LSD (5%)	0.001	--	--
CV (%)	47.28	38.04	46.16

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

Table 8: *Effect of different growth hormones on dry shoot weight per plant at 1, 2, and 3 months after planting*

Treatment	1	2	3
0%BA	0.1273	0.5473	1.9523
10%BA	0.0583	0.4453	1.6363
20%BA	0.1580	1.6070	2.2835
30%BA	0.1025	0.5300	1.5393
0%AA	0.0835	0.3048	1.0355
10%AA	0.0853	0.4403	1.4253
20%AA	0.0908	0.3265	1.5693
30%AA	0.1420	0.2668	1.5733
LSD (5%)	--	--	--
CV (%)	66.18	48.07	45.2

Means followed by same letter(s) are said not to be statistically significant at 5% level of probability.

4. CONCLUSION

From the present investigation, *Parkia biglobosa* is a slow growing species like it had been reported for several indigenous tree species in Nigeria and West Africa (*Dialium guineensis* and *Vitellaria paradoxa* (Oni, 2002). This problem makes the various treatments effect not to be fully expressed even at the expiration of these study.

It was however observed that plants treated with no treatment sprouted earlier than the one treated with growth hormones.

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