THE EFFECTS OF FISH POND SEDIMENTS AND COW DUNG ON THE EARLY GROWTH OF *Afrormosia elata* HARMS SEEDLINGS.

ABSTRACT

More often than not, emphasis is laid on the essence of employing organic manures for raising plant seedlings and even in improving the nutrient status of their growth media for higher productivity. Afrormosia elata has numerous medicinal uses but not very much available. Thus, the study on the effects of fish pond sediments (FPS) and decomposed cow dung (DCD) on the early growth of A. elata seedlings was carried out at the nursery 'A' of the Federal College of Forestry, Ibadan, Nigeria. A. elata seeds were sown in a finely perforated sieve (filled with washed river sand) and seedlings were pricked – out 2 weeks after seedling emergence into polythene pots with varying levels of FPS and DCD. The experimental design was Completely Randomized Design (CRD) consisting of nine treatments and eight replicates (2kg of top soil served as control while other treatments consisted of various ratios of top soil with either FPS/ DCD or without top soil). Morphological parameters and leaf biomass were assessed and the data collected were subjected to Analysis of Variance (ANOVA). The result showed that T_3 (1500g FPS + 2Kg TS) had the best performance in height, leaf area and leaf biomass with mean values of 11.02cm, 21.65cm^2 and 1.16g respectively. Significant differences were observed at $P<0.05$.The means were separated using Duncan Multiple Range Test (DMRT). Thus, it was recommended that T_3 could be employed in raising the seedlings of this plant for faster growth rate.

Keywords: *A. elata*, fish pond sediments, cow dung, top soil, growth parameters.

INTRODUCTION

Aquaculture has been widely developed in recent years for food security and income generation (Lin and Yi, 2003). Lin and Yakuptiyage (2003) had also reported that successful management of tropical fish pond for biologically optimal fish growth requires supply of necessary pond inputs including nutrients in a balanced manner via fertilization and supplementary feeding. However, Boyd *et al*. (2006) stated that the accumulation of the sediments enriched with organic matter and other nutrients is a major concern affecting the intensification and management in ponds. Therefore, maintenance of pond volume and its environment by sediment removal is a conducive practice for profitable fish production. Pond sediments had become a widespread concern but on the contrary, the use of pond sediments in agricultural and forest land as fertilizer supplement and soil conditioner have proved to be the best management option which can be used in raising agricultural crops as well as forest tree species (Rath, 2000). Similarly, urban dwellers are beginning to show more interest in fish farming to improve household nutrition. It is therefore imperative to employ animal wastes such as fish pond sediments and cow dung (as manure) for boosting forest and agricultural crop production.

Cow dung is an organic fertilizer that is cheap, popularly used and readily available for use in enhancing soil nutrient status and improving crop yield especially in semi - urban areas (Shahen *et al.***,** 2010). Akande *et al.* (2006) described it as a type of farm yard manure which is mainly excreta collected from cattle which can be applied as manure in the form slurry or dried to improve soil physicochemical properties that are important for plant growth. Moreover, the need to increase the productivity of tree species which has great economic importance and high value in the international market cannot be overemphasized. *Afrormosia elata* (Harms) is one of such tree species that possess these qualities.

A. elata also known as *Pericopsis elata* (Harms) belongs to the kingdom Plantae and Phylum Tracheopyta. It is a leguminous species and belongs to the family Fabaceae. *A. elata* is a gregarious species restricted to the drier part of semi-deciduous forest. It is usually found in Central and West Africa. It is a large tree which may be recognized readily by its bark which flakes - off in thin irregular patches leaving bright reddish colour beneath. It is known for its beautiful colouration which ranges from golden to darker brown gradually turning to a deep rich, walnut like colour (ITTO, 2005). The seeds of *A. elata* germinate/emerge (as seedlings from seeds) rapidly in about 8 days (Kyereh *et al.*, 1999). Burslen and Miller (2001) reported that under full sunlight, the seedling emergence rate is low and is only about 5% in localities where seedlings receive full sunlight in the morning but better seedlings' growth is optimal when shaded from direct midday sun.

Objective of the study

The study focuses on the evaluation of the effects of fish pond sediments and decomposed cow dung (organic manures) on early growth rate of *A.*

elata seedlings.

MATERIALS AND METHOD

This study was conducted at the screen house of the Federal College of Forestry Ibadan, Nigeria. The college is located at Jericho Quarters in Ibadan North West Local Government Area of Oyo State Nigeria. The area lies on between latitude70 26^1N and longitude 30 36^1E. Regarding the climatic conditions, the area is typically in the rain forest zone, with annual rainfall of 1,400mm–1,500mm, average temperature of about 31. 2^0C and relative humidity of about 65%. The eco-climate of the area is of two distinctive seasons, the dry season usually commences from November to March and rainy season from April to October (FRIN, 2015).

A. elata seeds were extracted from its pods and sown directly into sieve (finely perforated) filled with washed and sterilized river sand. Watering was done daily (morning). After seedling emergence (S.E), 76 seedlings of uniform sizes were selected for further transplanting into already prepared polythene pots with various treatments. Polythene pots of size (23cm x l9cm x l3cm) were used for the experiment. The experiment was laid out in Completely Randomized Design (CRD). There were 9 treatments and 8 replicates. The treatments include: To= 2kg of top soil (control), T1 = 2kg of fish pond sediments, T***2*** = 2kg of decomposed cow dung, T3= 2kg of top soil + 1.5kg of fish pond sediments, T4 = 2kg of top soil +100g of fish pond sediments, T5= 2kg of top soil + 500g of fish pond sediments, T6= 2kg of top soil + 150g of cow dung, T**7=** 2kg of top soil + l00g of cow dung, T8**=** 2kg of top soil + 50g of cow dung. Growth Parameters assessed include: seedling height (cm), leaf count, stem diameter (mm), leaf area (cm^2) and leaf biomass (g). Data collected were subjected to Analysis of Variance (ANOYA) and means were separated using Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

It was observed from the chemical analyses, that cow dung had a higher percentage of nitrogen (narrowly) than fish pond sediments with values of 1.34cmol/kg and 1.15cmol/kg (respectively). Though, fish pond sediments had higher percentage of phosphorus and potassium (7.34cmol/kg and 5.6mg/kg respectively) than cow dung (1.0cmol/kg potassium and 1.5cmol/kg phosphorus respectively). This corroborated the findings of Nemati *et al.* (2000) who affirmed the effectiveness of pond sediments as a soil conditioner (Tables 1 and 2 below).

Table 1: Chemical analysis of cow dung

Parameters	*Quantity*
Nitrogen (%)	1.34 cmol/Kg
Ca+ + (mg/lOOg)	2.34cmo/Kg
Fe++ (cmol/Kg)	3.40mg/Kg
K-M(mg/100g)	1.22 cmol/Kg
K (%)	1.4 cmol/Kg
C (%)	8.23 cmol/Kg
P (%)	1.5 cmol/Kg
Na (%)	1.34cmol/Kg
Mg (%)	0.21cmol/kg
Cu (%)	20.4mg/Kg
Zn (%)	120.6mg/Kg
Mn (%0	115mg/Kg

Table 2: Chemical analysis of fish pond sediments

Parameters	Quantity
pH (H_20)	7.12
C (%)	4.78
T.N (%)	1..15
P (mg/Kg)	5. 60
H^+	0.30
Particle sizes (%)	
Sand	85.60
Clay	09.00
Silt	05.40
Exchangeable bases	
Na	2.28 mg/1
K	7.34mg/l
Ca	2.9cmol/Kg
Mg	1.05 cmol/Kg
Micro nutrients	
Mn	3.0 mg/Kg
Fe	4.5
Cu	1.0
Zn	1.1

Table 3: Soil physicochemical analysis of top soil

Parameters	Quantity

P^H	6.65
OM(%)	4.54
TN(%)	3.12
Av. P(ppm)	23.24
K(mg/kg)	5.30
Ca(mg/kg)	6.80
Mg($cmol_c$/kg)	1.26
Cu($cmol_c$/kg)	0.72
Na(mg/kg	2.20
Zn(mg/kg)	2.04
Mn(mg/kg)	3.64
EA($cmol_c$/kg)	1.66
ECEC($cmol_c$/kg)	23.62

Table 4: Mean plant height (cm) of *A. elata* seedlings

Trt	Wk2	Wk4	Wk6	Wk8	Wkl0O	Wkl222	Mean
To	8.58	9.72	10.60	11.36	13.60	15.74	10.77
T1	7.72	8.64	9.93	10.64	12.36	14.10	10.04
T2	6.66	8.08	9.08	9.84	11.28	12.56	8.99
T3	7.82	9.07	10.62	11.98	14.40	17.04	11.02
T4	8.03	8.80	9.70	10.35	12.38	15.23	10.20
Ts	8.73	9.68	10.39	11.03	12.83	14.28	10.59
T6	7.15	8.18	9.60	9.93	11.90	13.38	9.36
T7	8.36	9.26	10.48	11.32	12.50	13.74	10.40
T8	7.90	8.90	10.28	11.08	12.32	13.64	10.14

From Table 4, it was observed that T**3** (1500g of FPS + 2kg TS) had the overall highest plant height with the mean value of 11.02cm at week 12, followed by To (2kg TS) with the mean value of 10.77cm, while T***2*** (200g CD) had the least height with the mean value of 8.99cm. However, in comparison, it was observed that treatment having fish pond sediments in them performed better than those with cow dung and top soil. This might be due to the fact that fish pond sediments had a higher phosphorus and potassium contents than cow dung hence, as indicated in Tables 1 and 2 thereby improving seedlings growth in addition to the nitrogen content of the top soil. This corroborated the findings of Rahman and Yakuptiyage (2006) who reported that application of Tilapia pond soil provided the required amount of phosphorus to *Ipomoea purpurea* (morning glory) plant which significantly improved the soil aggregate stability and hence supported the plant growth. Though there was no significant difference among the treatments at 5% probability level (Table 4).

Table 5: Mean stem diameter (mm) of *A. elata* seedlings

Trt	*Wk 2*	*Wk 4*	*Wk6*	*Wk8*	*WklO*	*Wkl2*	*Mean*
To	0.80	1.57	1.78	*2.02*	2.29	2,55	1.61
T1	0.64	1.39	1.72	1.83	1.93	2.33	1.47
T*2*	0.60	1.30	1.55	1.75	1.90	*2.00*	1.38
T3	0.79	1.47	*)* .69	1.92	2.16	2.40	1.52
T4	0.85	1.23	1.42	1.99	2.16	2.29	1.47
T5	0.62	1.43	1.90	2.07	2.35	2.63	1.61
T6	0.72	1.47	[illegible]	1.92	2.07	2.30	1.49
T7	0.70	1.41	1.69	1.93	*2.11*	2.35	1.48
T8	*0.68*	1.39	1.65 .	1.90	2.07	2.31	1.45

Table 5 above shows that To (2kg TS) and T***5*** (500g FPS + 2kg TS) had the best performance in stem diameter with mean value of 1.61 mm, followed by T3 (1500g FPS + 2Kg TS) with the mean value of 1,52mm, while T***2*** (200g DCD) had the lowest stem diameter with the mean value of 1.38mm. Furthermore, it was observed that all treatments having fish pond sediments had better performance when compared with those having cow dung. This result is therefore in support of the findings by Rahman and Yakupitiyage (2006) who stated that the addition of fish pond sediments to agricultural soil usually favours the development of soil structure and root penetration, aeration and water percolation. Thus, the potential productivity of crop plants is reasonably improved. However, there was no significant difference among the treatments at 5% probability level..

Table 6: Mean leaf count *of A. elata* seedlings

Trt	Wk2	Wk4	Wk6	Wk8	WklO	Wkl2	Mean
To	5.20	5.60	6.60	9.20	12.60	16.60	8.20
Ti	4.40	5.80	7.20	9.00	11.40	13.20	7.57
T_2	2.40	3.40	3.80	6.40	7.80	9.20	. 4.52
T_3	3.40	5.80	8.20	8.60	11.60	14.80	7.77
T4	3.25	5.00	6.75	9.50	12.25	16.75	7.93
Ts	5.25	6.50	9.00	13.25	15.75	20.50	10.3
Tf,	4.00	4.50	5.00	7.75	11.75	13.50	7.00
Tv	3.5	4.00	5.00	6.80	8.20	12.20	6.01
Ts	4.20	5.80	7.00	8.60	10.20	12.60	7.20

The Table 6 above shows the mean leaf count or number of leaves of *A. elata* seedlings. The overall best treatment was T5 (500g FPS + 2Kg TS) with the mean value of 10.32, followed by To (2Kg TS) with the mean value of 8.20, while T***2*** (200g CD) had the lowest leaf count with the mean of 4.52. Furthermore, it was observed that every treatment having Fish pond sediments in them performed excellently compared with those having cow dung, this may be due to higher content of Phosphorus and Potassium in fish pond sediments compared to that of the cow dung which corroborated the findings of Yang and Hu, (2002) who reported that fish pond sediments met up with Nitrogen and Potassium requirements for corn growth (Nitrogen from the top soil augmented the initial quantity in FPS or DCD. However, there was no significant difference among the treatments at 5% probability level.

Table 7: Mean leaf area (cm^2) of *A. elata* seedlings

Trt	Wk2	Wk4	Wk6	Wk8	WklO	Wkl2	Mean
To	11.28	14.03	16.62	18.48	21.18	22.66	16.45b
T1	12.50	14.27	: 6.27	18.83	22.47	27.49	17.4 lab
T2	10.37	11.86	14.44	16.62	17.13	10.03	13.26a
T3	13.44	17.67	22.10	25.90	28.36	31.88	21.65ab
T 4	14.19	17.1	\ 8.48	20.72	23.40	20.03	17.98ab
T5	5.54	16.43	18.87	20.69	25.68	29.11	19.72b
T6	11.66	15.23	17.49	26.59	28.78	30.41	20.00ab
T 7	12.49	14.43	17.38	19.57	22.46	24.39	17.28ab
T8	14.90	14.97	18.49	20.98	23.24	24.75	15.43ab

Means with the same letter are not significantly different from one another.

Table 7 shows that T3 (1500g FPS + 2Kg TS) had the overall best leaf area with the mean value of 21,65cm^2, followed by T***5*** (100g CD + 2Kg TS) with the mean value of 20.00cm^{2} while T***2*** (200g CD) had the lowest leaf area with the mean value of 13.26cm^2. It was also revealed that treatments with fish pond sediment had better performance compared with those of cow dung. This study also supported the findings of Rahman *et al.,* (2004) who stated that since fish pond sediment can be used in mushroom culture as substrate and in pasture, fruit orchards and turf grass production etc and it has the potentials of being utilized in agriculture due to its high nutrient status. However, there was significant difference among the treatments at 5% level of probability (Table .

Table 8: Mean biomass (g) accumulation of *A. elata* seedlings

Trt	*Wk2*	*Wk4*	*V/k6*	*Wk8*	*WklO*	*Wkl2*	*Mean*
To	*0.50*	*0.81*	*1.01*	*1.19*	*1.37*	*1.56*	*1.07ab*
Ti	*0.39*	*0.40*	*0.56*	*0.78*	*0.99*	*0.15*	*0.71a*
T2	*0.37*	*0.41*	*0.54*	*0.70*	*0.87*	*0.99*	*0.65a*
T3	*0.38*	*0.45*	*0.69*	*1.31*	*1.94*	*2.17*	*1.16b*
T4	*0.55*	*0.62*	*0.71*	*1.10*	*1.48*	*1.57*	*l.Olab*
T5	*0.27*	*0.60*	*0.84*	*1.34*	*1.85*	*2.08*	*1.16b*
T6	*0.43*	*0.45*	*0 59*	*0.79*	*0.99*	*1.13*	*0.73a*
T 7	*0.41*	*0.47*	*0.61*	*1.15*	*1.69*	*1.82*	$1.03_{a}b$
T8	*0.60*	*0.70*	*0.71*	*1.06*	*1.41*	*1.43*	0.99_{ab}

Means with the same letter are not significantly different from one another

Table 8 shows the mean seedlings biomass accumulation of *A. elata*. It was revealed that T***3*** (1500g FPS + 2Kg TS) and T***5*** (500g FPS + 2Kg TS) had the best performance with both having the mean value of 1.16g, followed by To (2Kg TS) with the mean value of 1.07, while T***2*** (200g CD) had the overall lowest biomass accumulation with mean value of 0.65. Furthermore, the result shows that all treatments having Fish Pond Sediments in them performed better than treatments with cow dung. This was due to the high content of organic matter in Fish pond sediments which supported the seedlings biomass accumulation. Hence, the study supported the findings of Rahman *et al*., (2004) who reported that fish pond sediments performed multiple function and roles in the overall production of a farmland its uses as fertilizer for crops. The differences among the treatments were significant at 5% probability level.

Conclusion

The result obtained from this study revealed that fish pond sediments had the largest values in all parameters assessed while decomposed cow dung had the least performance in all parameters assessed. It was therefore recommended that the use of fish pond sediments be adopted by both silviculturists and farmers as a source of manure in raising their seedlings and agricultural crops since it provides the soil with necessary nutrients (e. g. Nitrogen, Phosphorus, Potassium and Organic matter) needed to support plant growth, development and yield.

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