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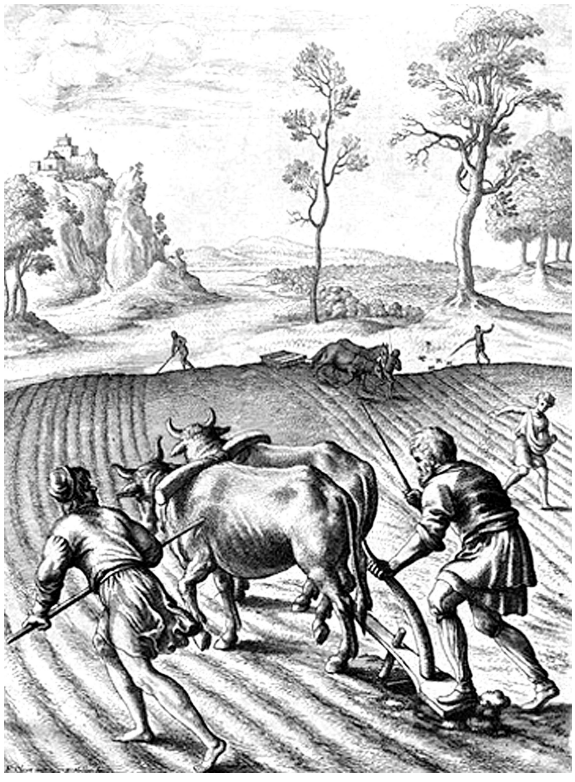

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Response of Raphia Palm [*Raphia hookeri* (Mann and Wendland)] Seedling to Various Rates of Organic and Inorganic Fertilizer

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Abstract: The effects of varied rates of organic and inorganic fertilizer on *Raphia hookeri* seedling growth and development were investigated at the main nursery of the Nigerian Institute for Oil Palm Research during the 2000/2001 and 2001/2002 growing season. Goat dung manure (organic fertilizer) and NPKMg 12-12-17-2 (inorganic fertilizer) were evaluated at three rate (0, 28 and 56 g) per seedling. Vegetative characters of seedling such as height, stem girth, number of frond production and dry matter production were optimized when goat dung manure and NPKMg 12-12-17-2 were applied at 28 g per seedling and this was highly significant ($p \leq 0.01$) when compared with other rates. Increasing rates of application from 28 to 56 g did not produce any appreciable increase instead it causes decline in vegetative growth. There was no significant difference observed between goat dung manure and NPKMg 12-12-17-2. Applied goat dung manure competes favourable with NPKMg 12-12-17-2 thus it can be use as alternate source of fertilizer for raising *R. hookeri* seedling in the nursery.

Key words: Application rates, goat dung manure, inorganic fertilizer, month after planting, raphia palm

INTRODUCTION

Raphia palm [*Raphia hookeri* (Mann and Wendland)] is a utility plants supply numerous products of social and economic importance especially in Southern Nigeria. The palms are valued for their fibre (Piassava) furniture materials, cosmetic by products and sap called palm wine, which is rich in vitamins, carbohydrates and yeast (Obahiagbon, 2007). Raphia palms contain pulp with long fibre suitable for the manufacture of paper (Odeyemi and Otedoh, 1988; Akpabio, 1998).

Raphia is a monocotyledonous tree crop like the oil palms, which require N, P, K and Mg for optimum growth, development and yield. However, their growth ecology differ, with raphia palms thriving on predominantly swampy areas which are mostly hydromorphic. Previous studies of nutrition requirement of raphia palms shown that inorganic fertilizer exert toxic effect on the palm resulting in high mortality rates, however, Udosen *et al.* (1988) and Udosen and Adesiyan (1985) shown that combined application of organic fertilizer and inorganic fertilizer with insecticide furadan enhanced vigorous and healthy growth of raphia palm seedling thus reduces mortality rates.

The use of organic fertilizers as a means of maintaining and increasing soil fertility has long been existed. This tradition has been somewhat neglected since the introduction of chemical fertilizers. Over the years, economic depression in the Sub-Saharan Africa has reduced the farmers' ability to purchase the much needed farm inputs such as inorganic fertilizers and other agro-chemicals for crop production.

This has inadvertently led to poor seedling establishment, pest attack, disease infestation and consequently low crop yield (Agboola *et al.*, 1990). The beneficial effect of organic materials has been studied by Odiete *et al.* (2000) and Udosen and Adesiyan (1985). Apart from supplying plants nutrients, it improves the physical properties of the soil. However, the use of goat dung manure as organic fertilizer in raphia palm production has not received research attention, whereas in many Asian Countries notably Pakistan, India, Philippian and Bangladesh, goat manure fetches a good price as organic manure (Odiete *et al.*, 2000).

In Nigeria large quantities of goat dung manure are available in goat markets and these products are environmental and health friendly. They are rich in plant nutrient especially N and K content. The recovery and reuse of waste materials for agricultural purposes is necessary in view of withdrawal of fertilizer subsidy by the government which had made chemical fertilizers scarce, expensive and beyond the reach of many peasant farmers. This study investigated the effect of goat dung manure application on growth and development of *R. hookeri* seedlings in the nursery when compared to various rates of inorganic fertilizer.

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Table 1: Chemical properties of goat dung manure and NPKMg 12-12-17-2

Properties	Goat dung manure (%)	NPKMg (%)
N	3.1	12
P	4.6	12
K	0.6	17
Mg	0.3	2
Ca	0.5	0

MATERIALS AND METHODS

The experiment was conducted at the Nigerian Institute for Oil Palm Research Main stations during the 2001/2002 cropping and 2001/2002 seasons. The nutrient status of the experimental site was estimated before the commencement of the trials. Soil samples were collected randomly at a depth of 0-15 and 15-30 cm using a tabular sampling auger. The soil samples were then analyzed for soil physical and chemical properties using standard soil analysis technique procedures or methods. Goat dung manure was curried, air dried and grinded. The grinded samples were wet digested and then analyzed for N, P, K and Mg using standard analysis procedures or techniques (Table 1).

The treatment consists of organic fertilizer (Goat dung manure) and inorganic fertilizer (NPKMg 12-12-17-2) at different rates 0, 28 and 56 g per seedling, were imposed on the seedlings laid out in a 2×3 factorial fitted into a randomized complete block design with three replications. Fertilizer was applied singly or combined. In case of combination, the mixture ratio was done as 50:50. Fertilizer at different rates were applied once at three months after planting (3 MAP). *R. hookeri* seeds obtained from Otegbo were sown into black polythene bags filled with top nursery soil from the experimental sites with one seed per polybag. Watering and other routine agronomic practices were done in the necessity.

Plant height, stem girth, number of frond production and dry matter yield, were collected in 12 months after planting. Plant height was measured with the aid of meter ruler from the base of the palm to the top of the drawn-up leaves. Stem, leaves and roots were over dried at 85°C for 36 h and weighted to obtained dry mater production. Data collected were subjected to analysis of variance (ANOVA) and different means in each treatment were separated using the Least Significant Differences (LSD).

RESULTS AND DISCUSSION

The soil used in the nursery trial when characterized (Table 2), had adequate pH, available P, low base nutrient status and consequently low base saturation with low total N, organic carbon and Effective Cation Exchange Capacity (ECEC). The soil has a low buffering capacity due to low Cation Exchange Capacity (CEC). Hence the soil is typical of soil supporting raphia palms (Aghimien and Aduayi, 2004).

Table 2: Soil physical and chemical characteristics at 0-15 and 15-30 cm

	Depth	
Properties	0-15 cm	15-30 cm
pH	5.05	5.90
N (g kg^{-1})	0.12	0.01
C (g kg^{-1})	19.95	0.04
P (Mg kg^{-1})	8.10	16.10
K (Cmol kg^{-1})	2.34	0.08
Ca (Cmol kg^{-1})	1.02	1.26
Mg (Cmol kg^{-1})	0.30	0.60
Na (Cmol kg^{-1})		0.30
Soil particle sizes		
Sand (%)	85.30	86.30
Sill (%)	2.90	1.90
Clay (%)	11.80	11.80
Textual class	Loamy sand	Loamy sand

Table 3: Effect of GDM and NPKMg on seedling height (cm) of R. hookeri at 12 months after planting

	Rates of application g seedling^{-1}			
Fertilizer	0	28	56	Mean
GDM	88.57	102.80	100.77	97.38
NPKMg 12-12-17-2	92.73	107.13	103.17	101.01
GDM + NPKMg 12-12-17-2	93.13	108.37	101.87	101.12
Means	91.48	106.10	101.93	
LSD (0.05)				
Fertilizer	NS			
Rates	2.040**			
Fertilizer×rates interaction	NS			

NS: Non Significant, **: Highly Significant

Seedling height: Single and combined application of various rates of Goat Dung Manure (GDM) and NPKMg 12-12-12-17-2 (Rustica) significantly ($p<0.01$) enhanced seedling height (Table 3). Seedlings respond positively to organic and inorganic fertilizer applied at various rates. Highest seedling height was produced at 28 g per seedling and this was highly significant. Increasing fertilizer rates from 28 to 56 g per seedling did not produce any appreciable increased on seedling height instead resulted in decline of seedling height. The least seedling height was recorded in the control.

Fertilizer application and various rates of application did not produced any significant different at 12 months after planting (Table 4).

Stem girth: Fertilizer application and various rates of application had significant ($p<0.05$) effect on stem girth (Table 5). Plant receiving 28 g of GDM and NPKMg 12-12-17-2. Singly and combined had greater stem girth at 12 MAP than any other rates. Interaction has no significant effect. GDM showed high compatible combination as organic fertilizer along with inorganic fertilizer NPKMg 12-12-17-2 in enhancing seedling

Table 4: Effect of GDM and NPKMg 12-12-17-2 on *R. hookeri* seedling on number of frond produced at 12 Months after planting

	Rates of application g seedling^{-1}			
Fertilizer	0	28	56	Means
GDM	10.53	10.96	10.43	10.64
NPKMg 12-12-17-2	10.86	10.98	10.63	10.82
GDM + NPKMg 12-12-17-2	10.60	11.20	10.73	10.83
Means	10.66	11.04	10.60	
LSD (0.05)				
Fertilizer	NS			
Rates	NS			
Fertilizer×rates interaction	NS			

NS: Non significant

Table 5: Effect of GDM and NPKMg 12-12-17-2 on seedling girth (cm) of *R. hookeri* at 12 months after planting

	Rates of application g seedling^{-1}			
Fertilizer	0	28	56	Means
GDM	10.40	12.33	11.66	11.46
NPKMg 12-12-17-2	10.86	13.20	11.86	11.97
GDM + NPKMg 12-12-17-2	11.13	13.00	12.16	12.10
Means	10.80	12.84	11.90	
LSD (0.05)				
Fertilizer	0.432*			
Rates	0.501**			
Fertilizer×rates interaction	NS			

NS: Non significant, *: Significant, **: Highly significant

Table 6: Effect of GDM and NPKMg 12-12-17-2 on dry matter yield (g/palm) of *R. hookeri* at 12 MAP

	Rates of application g seedling^{-1}			
Fertilizer	0	28	56	Means
GDM	116.7	157.3	152.5	151.8
NPKMg 12-12-17-2	129.2	174.4	147.1	150.2
GDM + NPKMg 12-12-17-2	124.0	179.0	158.2	153.7
Means	123.3	170.2	152.6	
LSD (0.05)				
Fertilizer	NS			
Rates	5.81**			
Fertilizer×rates interaction	NS			

NS: Non significant, **: Highly significant

growth and developments. This result is in accordance with early finding of Secretaria and Maravillia (1992) and Cardigal and Maravillia (1992) on coconut were goat manure compete favourably with inorganic fertilizer as fertilizer for manuring coconut palm.

Dry matter yield: Seedling dry matter was significantly influences ($p \leq 0.01$) by various rates of fertilizer application (Table 6). There was no significant differences between goat dung manure and NPKMg 12-12-17-2. Fertilizer applied at the rate of 28 g per seedling produced the highest dry matter yield and was significantly different from other rates. Increasing fertilizer from 28 to 56 g per seedling significantly reduced dry matter yield (Table 6). Application of goat dung manure and NPKMg 12-12-17-2 either singly or combined removed nutritional limitation and promote vigorous and healthy growth of *R. hookeri* seedling when compared to the control that has the least dry matter yield.

Goat dung manure contain organic matter and nutrients which are readily available for improving and conditioning the soil for the nutrient supply of the palm and thereby increase seedling growth and development. The result of this present study has established early funding of Secretaria and Maravilla (1992) that goat dung manure consistently improved qualities relative to fertility levels especially for organic matter and total N, thus lead to a better vegetative and yield performance of coconut palms from seedling to bearing stage than other organic manures. They further stated that goat dung manures exhibited consistently, good nut yields and thus they concluded that it can be considered as potential source of fertilizer for coconut palms.

CONCLUSIONS

Goat dung manure and NPKMg 12-12-17-2 enhanced vigorous and healthy growth of *R. hookeri* seedlings. Goat dung manure competes favourably with NPKMg 12-12-17-2. Considering the size of goaty industry in Nigeria, utilizing goat dung manure in raphia production would be a good means of reducing the cost of seedling production due to scarcity and high cost of conventional fertilizers. In all, it is evident that goat dung manure can be a good source of plant nutrients that is compatible with the environments especially.

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