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YIELD OF *RAPHIA HOOKERI* (MANN AND WENDL) AS INFLUENCED BY COMBINED APPLICATION OF POULTRY MANURE AND NPKMG 12:12:17:2 FERTILIZERS IN FRESH WATER SWAMP

[1]Imogie, A. E. [2]Abu, R. A., [3]Audu, I., [4]Abdul-Qadir, M. I. and [5]Ugiagbe, I. M.,

[1]Agronomy Division,[2,3,& 4] Agricultural Economics Division, [5] Physiology Division, Nigerian Institute for Oil palm Research (NIFOR), Benin City, Edo State, Nigeria.

ABSTRACT

The study investigated the impact of combined application of poultry manure and NPKMg 12:12:17:2 fertilizer on *Raphia hookeri* palm sap production, with a view to determining the optimum fertilizer rates required by *R. hookeri* for optimum yield. The trial was conducted at the Nigerian Institute for Oil palm Research (NIFOR) Raphia experimental station, Otegbo, Delta State. It was a 2 x 4 factorial arrangement in a randomized complete block design (RCBD) in three replicates. Data were collected on yield traits such as number of green leaves cut, number of spadices, height at tapping, percentage of flowering palms, duration of tapping and palm sap yield. Data generated were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan's new multiple range test.(DNMRT) The result indicated that combined application of poultry manure and NPKMg fertilizer at varied rates increased soil extractable nutrients which enhanced *Raphia hookeri* sap yield over that of the control palms that were not fertilized. Combined application of poultry manure and NPKMg rates showed a progressive significant effect on all parameter measured except on duration of tapping. Highest palm sap yield (1140.6 Litres/palm) resulted from the combined application of 1.0kg poultry manures/palm and 1.0 Kg NPKMg/palm on the same palm. The lowest palm sap yield (345.2 Litres/palm) was obtained from the control plot (zero application). Palm sap production of *Raphia hookeri* increased as combined application of poultry manure and NPKMg rates increased until optimum rates of 1.0 kg poultry manure and 1.0 kg NPKMg/palm/year. At higher rates of combine application of poultry manure (1.0kg) and NPKMg (1.5kg)/palm/year, increase in the yield of other parameters and palm sap were not significant. The increase in sap and other yield parameters of *R. hookeri* when treated with combine application of poultry manure and NPKMg 12:12:17:2 fertilizer over that of the control is an indication that optimum yield of *R. hookeri* can be achieved when relevant nutrients are provided.

Keywords: *Raphia hookeri*, Poultry manure and NPKMg, Freshwater, Swamp

INTRODUCTION

Raphia hookeri (Menn and Wandl.), is a global, economic tree and source of food for humans, animals and fish. It is an important crop supplying local and international demands for palm sap, diesel and raw materials for industry. The hydromorphic soils supporting *Raphia hookeri* have low inherent soil nutrients and apart from poor drainage, the cation exchange capacity (CEC) is very low. Nitrogen (N) and Potassium (K) deficiencies are the major limiting factors in these soils. *Raphia hookeri* requires these elements for growth, development and yield. To ensure continuous supply and production in the long run, the condition of the soil with emphasis on macronutrient, in Raphia palm plantation must be maintained or improved. Therefore, adequate nutrient must be supplied to the palm for optimum growth, development and production. According to Aghimien, *et al* (2011), the hydromorphic soils supporting Raphia palm cultivation in Nigeria are deficient in macro and micro nutrients. Ndon (2003) also stated that there is a decline in the yield of Raphia palm plantation in Nigeria, due to persistent decline in soil fertility. This implies that inadequate supply of these elements will results in poor growth, development and yield which can adversely affect its cultivation.

The need for fertilizers to optimise returns from palms is well established. Currently several farmers have shown interest in the cultivation of *Raphia hookeri* but their effort is limited by inadequate information on the native nutrient status of soil supporting the crop and developed agronomic technology for its cultivation. With the present agricultural policy by Nigeria government to diversify the economy from sole dependence on petroleum to agriculture in order to alleviate poverty and economic empowerment of her citizens, more people are attracted to agriculture.

The under-utilization of the Nigerian South-South region's coastal swampy soils supporting *Raphia hookeri* production may be attributed to lack of developed technology for large holder agricultural production and inadequate information on the management practices in the swampy soils. Increased *R. hookeri* cultivation will not only require additional inputs such as N, P, K and Mg, but also micro - nutrients to sustain high and improved yield. Since little seems to have been done in *R. hookeri* nutritional requirement, this study was carried out to investigate the effects of poultry manure and NPKMg fertilizers on *R. hookeri* development and palm sap production.

MATERIALS AND METHODS

The experiment was conducted at the Nigerian Institute for Oil Palm Research (NIFOR) Raphia experimental station, Otegbo (Latitude 4º 45′ N to 5º 45′ S and Longitude 6º 25′ W to 6º 35′ E), Delta State, Nigeria. The level of rainfall is high with mean annual range of 1500 to 4000 mm for 9 – 10 months in a year with short period of 2 months of dry season in December and January. Annual temperature ranges from 23-31ºC with a high relative humidity of about 78-82% and decreases slightly. Otegbo's soils are of young geologic formation of the quaternary and recent alluvium underlain by cretaceous sediments and are extensively low lying. The topography of the study area was divided into three plains namely upper plain (dry land), lower plain (moderately waterlogged) and lowest plain (completely waterlogged). The upper plain is flat and not usually flooded except towards the end of the rainy season, the lower plain is undulating with contour bounds and usually flooded but not completely waterlogged while the lowest plain is completely flooded (waterlogged).

The experiment commenced in 2009 and ended in 2019. It was a 2 x 4 factorial arrangement in randomized complete block design (RCBD). The trial was made up of eight treatments in three replicates with two palm lines making a block and each plot contained 8 palms with each block and plot separated from each other with palm line as a guard row. Thus, the distance of one block to the other was approximately 12 m. The treatments consisted of two factors namely: - Poultry Manure as factor 1 at two levels (0.5 and 1.0 kg/palm/year) and NPKMg 12:12:17:2 Fertilizer as factor 2 at four levels (0, 0.5, 1.0, and 1.5kg/palm/year) respectively. The Poultry Manure was sourced from a poultry farmer and cured by air -drying and then sieved to pass through 5 mm sieve to remove debris. The Poultry Manure was analysed to determine its nutrient composition as shown in Table 1.

Fertilizers were applied once in a year by flip application at the palm base on the 2 m ring weeded diameter at 0.5 – 1 m away from the palm base (NIFOR, 1983). Data were collected on height at tapping (meter), number of green leaf cut at tapping, number of spadix opened, percentage of flowering palm per treatment, duration of tapping (number of days) and palm sap yield (litres/palm). The data collected were subjected to analysis of variance (ANOVA) using the GenStat (2008) procedure. Significant means were separated using the Duncan's New Multiple Range Test (DNMRT) method (Steel and Torrie, 1984) at $P \leq 0.05$

RESULTS AND DISCUSSION

Nutrient composition of poultry manure: Poultry Manure collected were cured and then analysed for its nutrient composition. Results of its chemical analysis as presented in Table 1, showed that poultry manure is high in nitrogen but low in potassium, magnesium and calcium when compared to NPKMg 12:12:17:2 which was very high in potassium. Aghimien, *et al* (2011) reported that *R. hookeri* nutrients demand increases as its growth progresses and they concluded that at fruiting stage *R. hookeri* requires high amount of potassium. The potassium percentage in poultry manure is very low while it is high in NPKMg 12:12:17:2, thus the use of poultry manure as fertilizer for *R. hookeri* will be best when combined with inorganic fertilizer that is high in potassium.

Effect of Combined Application of Poultry Manure and NPKMg 12:12:17:2 on Palm Sap Production and Yield Components: Palm sap production and yield components were significantly affected ($P \leq 0.05$) by combined application of varied rates of poultry manure and NPKMg 12:12:17:2 interaction. The impact of combined application of poultry manure and NPKMg 12:12:17:2 on *R. hookeri* percentage flowering, number of green leaves opened or cut and number of spadix cut are presented in Table 2. Applied poultry manure and NPKMg rates markedly had significant ($P \leq 0.05$) effects on number of green leaves cut or opened, number of spadices cut, percentage of flowering. All parameters measured were significantly influenced by combined application of organic and inorganic fertilizers except height at tapping. The result of the statistical analysis showed that time of flowering plots treated with varied rates of combined application of organic and inorganic fertilizers flowered earlier and also the number of flowered palms per hectare were significantly ($P \leq 0.05$) different from that of the control plots. Palms treated with combined poultry manure and NPKMg 12:12:17:2 came to flowering between six to seven years of planting while the control came to flowering between eight to nine years of planting. The effect of combined application of poultry manure and NPKMg 12:12:17:2 on *R. hookeri* duration of tapping and palm sap production or yield are presented in Table 3. Combined application of poultry manure and NPKMg fertilizer enhanced the soil nutrients which greatly influenced *R. hookeri* palms yield over the control where no fertilizer was applied. Highest percentage of flowering (95%) and palm sap yield (1140.6 litres/palm) were obtained at combined application of poultry manure and NPKMg 12:12:17:2 at the rates of 1.0 kg/palm/year while the lowest percentage of flowering (47.9%) and palm sap yield or production (345.2 liters/palm) was obtained at the control. The significant effects of applied organic and inorganic fertilizers on percentage of flowering *R. hookeri* palms and the early flowering of palms can be attributed to the applied fertilizers. This supports the findings of Imogie, *et al.,* (2015) and Foster, (2003) on impact of fertilizers on *R. hookeri* palm sap production at Onuebum station, Bayelsa State, Nigeria. According to Brubaker (2005), for optimum crop production, organic fertilizer must be used in combination with inorganic fertilizers because organic fertilizer has numerous disadvantages which make it difficult to be used as sole fertilizer. The reason is that the nutrients content are released slowly and also takes long time to decompose. In addition, the content and form of nutrients is unknown thus it requires application of higher amount than may be necessary. The performance of the combined application of poultry manure and NPKMg fertilizer is better than either poultry manure or NPKMg fertilizer applied sole. This finding is in agreement with Udosen and Adesiyan (1985) who reported that combined application of organic and inorganic fertilizers significantly enhanced *R. hookeri* physical growth in the nursery. The combined application of poultry manure and NPKMg fertilizer performs better than either poultry manure or NPKMg fertilizer alone because the organic content of the poultry manure takes time to decompose. Also, it releases its nutrient slowly. On the other hand, NPKMg fertilizer, and organic fertilizer is easily mineralised and readily available to plants. However, it is easily lost through leaching and volatilization. Thus, the combined application of these fertilizers will help to prevent losses as the organic manures will help to improve the soil physical structures and also act as buffer thus preventing the loss of the inorganic fertilizer. Combined application of poultry manure and NPKMg fertilizer improved the soil nutrients and thereby influenced *R. hookeri* palms yield more than the control where no fertilizer was applied. Highest number of green leaves opened or cut for tapping (5) and number of spadices cut for tapping (5) were obtained at combined application of poultry manure and NPKMg 12:12:17:2 at the rates of 1.0 kg/palm/year respectively and this was significantly different from all other treatments. The lowest number of leaves opened or cut for tapping (2) and number of spadices cut at tapping (2) was obtained in the control. Applied organic and inorganic fertilizer showed a progressive significant effect on number of green leaves cut or opened for tapping and number of spadices cut. The difference in the yield due to application of poultry manure or NPKMg fertilizer alone and that of the control was not significant ($P \leq 0.05$). This finding is in agreement with Udosen and Adesiyan (1985) who reported that combined application of organic and inorganic fertilizers significantly enhanced *R. hookeri* physical growth at the nursery level. The better performance of combined application of poultry manure and NPKMg fertilizer than when

either poultry manure or NPKMg fertilizer is used alone is due to the fact that poultry manure which is organic fertilizer takes time to decompose and release its nutrient slowly while NPKMg fertilizer is easily mineralized and readily available to the plants but however it is easily lost by leaching and also through volatilization. Thus, the combined application of these fertilizers will help to prevent losses as the organic manures apart from improving the soil physical structures also act as buffer thus preventing the loss of the inorganic fertilizer.

CONCLUSION

The soils fertility status of hydromorphic soils supporting *R. hookeri* production are usually very low and would require adequate maintenance with application of organic and inorganic fertilizer, drainage and irrigation, if the soils are to be used for intensive sustainable crop production. Combined applications of organic (poultry manure) and inorganic fertilizer (NPKMg) improved the soil nutrient which in turn enhanced *R. hookeri* growth, development and yield. Combined application of organic and inorganic fertilizers is vital to attaining efficient nutrient uptake, high and sustainable yields o*f R. hookeri* palms. For optimum growth, development and yield, combined application of poultry manure and NPKMg 12:12:17:2 should be at the rate of 1.0 kg poultry manure and 1.0 kg NPKMg 12:12:17:2/palm/year.

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Table 1: Chemical composition of poultry manure used for the experiment

Chemical properties	Nutrient value (%)
N	3.1
P	4.6
K	0.6
Mg	0.3
Ca	0.5

Table 2: Effects of combined application of Poultry Manure and NPKMg 12:12:17:2 on height at tapping, number of green leaves opened and number of spadices opened

Poultry Manure (Kg/palm/year)	NPKMg (12:12:17:2) (Kg/palm/year)	Percentage flowering (%)	Number of green leaves cut	No. of spadices opened
0.5	0	49.7d	2c	2c
0.5	0.5	65bc	3b	3b
0.5	1.0	70b	3b	3b
0.5	1.5	73b	4ab	3b
1.0	0	58cd	3b	2b
1.0	0.5	75b	4ab	4ab
1.0	1.0	95a	5a	5a
1.0	1.5	95a	5a	5a

Means followed by the same alphabets within the same row are not significantly different from each other by Duncan's New Multiple Range Test (DNMRT) at $P \leq 0.05$

Table 3: Effects of combined application of Poultry Manure and NPKMg 12:12:17:2 on duration of tapping and palm sap production

Poultry Manure (Kg/palm/year)	NPKMg(12:12:17:2) (Kg/palm/year)	Duration of tapping	Palm sap production (litres/palm/year)
0.5	0	54d	345.2e
0.5	0.5	77bc	514d
0.5	1.0	80b	624.8
0.5	1.5	85ab	765.9c
1.0	0	77bc	560.8d
1.0	0.5	86a	906.5b
1.0	1.0	88a	1140.6a
1.0	1.5	88a	1135.0a

Means followed by the same alphabets within the same row are not significantly different from each other by Duncan's New Multiple Range Test (DNMRT) at $P \leq 0.05$