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Germination, Seedling and Early Growth of Monkey Kola (*Cola parchycarpa*) as Influenced by Different Organic Manures Mixed with Top Soil and White Sand in a Humid Tropical Rainforest Zone

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Abstract: A field trial on the influence of different organic manures mixed with top soil and white sand on the germination, seedling and early growth of monkey kola (*Cola parchycarpa*) was conducted at the Green house, Department of Agricultural Technology, Imo State Polytechnic Omuma. The objective was to determine the best organic manure that is appropriate for the germination, seedling and early growth of *Cola parchycarpa*. The experiment was arranged in a completely randomised design (CRD) replicated four (4) times. The treatments were: top soil and white sand alone (T_1) which acted as a control, 10 t/ha pig manure + top soil and white sand (T_2), 10 t/ha goat manure + top soil and white sand (T_3), and 10 t/ha poultry manure + white sand and top soil (T_4). Data were collected on germination percentage, emergence speed at germination while plant height, number of leaves/plants were collected at 4, 8, 12, 16, 20 and 24 weeks after planting (WAP). Analysis of variance (ANOVA) results showed that T_4 (10 t/ha poultry manure + top soil and white sand) gave the highest germination percentage of 68.3%, emergence speed of 80.3%, and influenced the mean plant height to a value of 35.8 cm and the number of leaves 14.7 leaves significantly different from all others. The lowest parameters were recorded for T_1 (top soil and white sand alone) throughout the experimental period.

Key words: Monkey kola, *Cola parchycarpa*, organic manure, seedling growth.

1. Introduction

Monkey cola (*Cola parchycarpa*) is an evergreen perennial indigenous fruit tree belonging to the family malvaceae, sub-family sterculionideae. The fruit trees are majorly found within South Eastern Nigeria and known with different local names according to tribes, Achicha in Igbo, Ndiyah in Efik.

It has different species which is, according to the colour of the edible pulp, *C. parchycarpa* (yellow), *C. lepidota* (white), and *C. lateritia* (red) [1]. *C. parchycarpa* and *C. lepidota* are the most common species and are available from June-November. It grows more in the wild but can also be found around villages or homes.

Monkey kola has a record of nutritional and medicinal value [2]. Nutritionally, the various arils differ in sweetness as revealed by the palatability assessment of the species fruits with *C. parachycarpa* (yellow) having relatively the most sweetest taste, *C. lepidota* (white) and *C. laterita* (red) in the order [3]. There is a high levels of vitamins obtained from the yellow pulp in *C. parchycarpa* (yellow) than *C. lepidota* (white) [4]. The fruit is scare but when taken or consumed, it is highly nutritious, delicious and filling. *C. parchycarpa* aril, seeds and fruit epicarp contain

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substantial amount of amino acids, vitamins and mineral elements required for nutrition which is shown on the fruit pulp [5].

Medicinally, the low energy, fat and protein juice produced from monkey kola makes juice suitable to be incorporated into the diet of individuals with physiological conditions [4].

The growth rate of any plant seedling during the nursery is greatly dependent on several cultural practices amongst which nutrient application remains prominent. Early studies reported significant influence of soil nutrients on the rate of germination and emergence of plant seedling such as monkey kola [6]. Organic manures release plant nutrients slowly for steady uptake by plants for healthy growth and development, preserve the quality of soil to bear the plant on sustainable basis as well as provide proper aeration and food for the useful soil microbes such as bacteria and fungi which assist the plant to prepare and assimilate food [7].

Major crops especially tropical fruits trees are not planted *in situ* hence need to be raised in the nursery, raising the trees in the nursery requires good soil media that will enhance proper rooting and seedling emergence.

Therefore the objective of this study was to evaluate the influence of different organic manures mixed with top soil and white sand on the germination and seedling growth of monkey kola (*C. parchycarpa*) in Owerri South East Nigeria.

2. Materials and Methods

The trial was conducted at Green House of the Department of Agricultural Technology, Imo State Polytechnic Omuma. The area is in the humid tropical rainforest zone of South Eastern Nigeria with a mean annual rainfall of about 2,500 mm, temperature 28-38 °C and a relative humidity of 89.5 percent [8].

2.1 Nursery Preparation

The nursery was prepared in a black polythene bags size of 30 × 45 cm and 500 cm guage perforated at the bottom to allow the drainage of water. Soil was collected at the area which had been left fallow for three (3) years. The surface of the soil was removed and top soil collected. The top soil was mixed with white sand and different organic manures which formed the treatment as follows: T_1 (top soil and white sand alone) which acted as a check, T_2 (10 t/ha pig manure mixed with top soil and white sand), T_3 (10/ha goat manure mixed with top soil and white sand), and T_4 (10 t/ha poultry manure mixed with top soil and white sand). Each polythene bag was filled with 2 kg of soil at the ratio or mixture of 3:2:1. Thereafter, seeds of *Cola parchycarpa* procured from the local market were planted into the polythene bags.

The experiment was arranged in a completely randomised design (CRD) with four replications making a total of sixteen (16) poly bags in the experiment. Data were collected on germination percentage, emergence speed at the emergence of the seedling while plant height, number of leaves/plants were collected at 4, 8, 12, 16, 20 and 24 weeks after planting (WAP). All data collected were subjected to analysis of variance (ANOVA) for CRD using [9] while the treatment means were separated using least significant differences (LSD) at 5% level of probability.

3. Results and Discussion

3.1 Germination Percentage

The result on the effects of different organic manures mixed with top soil and white sand is presented in Table 1. Germination percentage of monkey kola was highest on the plant grown on poultry manure 10 t/ha + top soil and white sand (T_4) which gave a value of 68.3 percent. T_2 (pig manure 10 t/ha + top soil and white sand) followed by a percentage value of 50 percent in the order. The lowest value of 25 percent was observed at T_1 (top soil and white sand alone).

3.2 Emergence Speed

Percentage speed emergence of monkey kola treated with 10 t/ha poultry manure + top soil and white sand

(T_4) produced the emergence speed of 80.3 percent higher than other treatments. However, T_1 (top soil and white sand alone) produced the lowest percentage speed emergence of 50 percent. Summary of the result is presented in Table 1.

3.3 Plant Height

The result of different organic manures mixed with top soil and white sand on the plant height of monkey kola is presented in Table 2. Application of organic manures influenced the height of monkey kola throughout the experimental period. Application of 10 t/ha poultry manure + top soil and white sand (T_4) gave the highest mean plant value of 5.0 cm at 4 WAP. The lowest value of 1.7 cm was obtained using top soil and white sand alone (T_1). The trend was the same throughout the experimental period up to 24 WAP which recorded the highest plant height of 35.8 cm significantly ($p > 0.05$) different from all others. The result obtained at T_1 (top soil and white sand alone) which was 23.3 cm was statistically the same with the value obtained using 10 t/ha goat manure + top soil and white sand (T_3) which is 24.3 cm. The shortest plants were consistently recorded at T_1 (top soil and white sand alone).

3.4 Number of Leaves/Plants

The number of leaves counted/plants of monkey kola was affected by the application of different organic manures as presented in Table 3. The results or values were significantly ($p > 0.05$) different. The highest number of leaves counted/plants was observed on the plant grown on 10t/ha poultry manure + top soil and white sand (T_4) which produced 3.7 leaves statistically the same with 10 t/ha pig manure + top soil and white sand (T_2) which gave a value of 3.3 leaves at 4 WAP.

At 24 WAP, the highest number of leaves of 14.7 leaves was obtained using 10 t/ha poultry manure + top soil and white sand (T4) which differed significantly ($p > 0.05$). The values obtained at 10 t/ha pig manure + top soil and white sand (T2) were 13.0 leaves and 10 t/ha goat manure + top soil and white sand (T3) gave a mean leaf number per plant of 12.0 leaves which was statistically at par. The lowest value on the mean number of leaves per plant of monkey cola was obtained at top soil and white sand alone (T1) throughout the experimental period.

Table 1 Germination percentage and speed emergence of monkey kola as affected by different organic manures mixed with top soil and white sand.

Treatments	Germination (%)	Speed emergence
T_1 (top soil and white sand)	25	50
T_2 (10 t/ha Pgm + top soil and white sand)	50	71.0
T_3 (10 t/ha Gm + top soil and white sand)	33.3	66.7
T_4 (10 t/ha Pm + top soil and white sand)	68.3	80.3
Mean	44.15	67.0

Table 2 Effects of different organic manures mixed with top soil and white sand on the plant height of monkey kola (*Cola parchycarpa*).

Treatments	Mean plant height (cm)					
	4	8	12	16	20	24
T_1 (top soil and white sand)	1.7	6.7	10.5	12.6	15.2	23.3
T_2 (10 t/ha Pgm + top soil and white sand)	3.9	10.2	13.0	18.0	21.7	25.4
T_3 (10 t/ha Gm + top soil and white sand)	2.09	7.12	12.5	15.1	17.0	24.3
T_4 (10 t/ha Pm + top soil and white sand)	5.0	14.0	22.2	29.5	32.0	35.8
LSD	0.4	2.1	2.4	2.6	3.4	3.5

Table 3 Effect of different organic manures mixed with top soil and white sand on mean number of leaves of monkey kola (*Cola parchycarpa*).

Treatments	Number of leaves					
	4	8	12	16	20	24
T_1 (top soil and white sand)	1.0	3.7	5.0	6.7	8.0	9.7
T_2 (10 t/ha Pgm + top soil and white sand)	3.3	4.2	5.6	8.3	11.4	13.0
T_3 (10 t/ha Gm + top soil and white sand)	1.7	3.8	5.3	7.0	8.3	12.0
T_4 (10 t/ha Pm + top soil and white sand)	3.7	5.0	6.7	10.3	11.3	14.7
LSD	0.2	1.9	2.1	2.3	2.7	2.9

Pgm: pig manure; Gm: goat manure; Pm: poultry manure.

4. Discussion

Several researchers have reported the importance of organic manures especially animal manures as an amendment strategy to improve the quality status of tropical soils. [10] reported that animal manures when efficiently and effectively used ensure sustainable crop productivity by immobilizing nutrients that are susceptible to leaching because nutrients contained in manures are released more slowly and are stored for a longer time in the soil ensuring longer residual effects, improved root development and higher crop yield.

Arora and Singh [11] in their findings reiterated that organic fertilizers enhance the growth of crops. The increase in growth index due to the use of poultry manure in the seedling and growth of monkey kola in the experiment indicates the superiority of poultry manure. All the growth parameters increased more than others on the plants grown on poultry manure. This is in conformity with the findings by Agbede *et al.* [12] that poultry manure application significantly influenced root weight, shoot weight and grain yield of sorghum.

Also, Udom *et al.* [13] reported that poultry manure application improved the yield of maize. The results of the superiority of poultry manure is due to the fact that poultry manure contains many nutrients and organic matter [14]. It is also stated that poultry manure improves plant growth [15].

5. Conclusion

Application of organic manures especially poultry manure at the rate of 10 t/ha has a superior effect on the germination and early seedling growth of monkey kola (*Cola parchycarpa*). Therefore, poultry manure is recommended as a fertility management strategy in the tropics where the soil is not fertile for improved crop production.

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