



## Research Article

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# Effects of Poultry Manure on The Growth of Lisbon Lemon (*Citrus limon*; var. Lisbon)

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## Abstract

The importance of poultry manure cannot be overemphasized. We conducted the field experiment in 2019 at the Organic Skill Acquisition Plot, Federal University of Agriculture, Abeokuta, (FUNAAB) Ogun State, Nigeria, to determine the growth of lemon (*Citrus limon*; var. Lisbon) as influenced by poultry manure application. We obtained poultry manure from FUNAAB poultry farm. A year-old Lisbon lemon plants were treated with poultry manure. We had treated and untreated Lisbon lemon plants. The treated Lisbon lemon plants received 3.25, 6.5, and 13 kgha-1, respectively while the untreated did not receive poultry manure which served as control. The poultry manure was applied to the treated Lisbon lemon plants by using double split method (by digging a hole around the tree trunk). The poultry manure application was done from 1st of August 2019 to the 8th of October 2019 respectively. Data were collected fortnightly on plant height, canopy diameter, number of leaves, stem girth, and leaf area. Results demonstrated that the application of 13 of kgha-1 PM significantly increased all the observed parameters compared to other treatments. In conclusion, the application of 13 kgha-1 of PM on Lisbon lemon plants optimized growth parameters.

**Keywords:** Poultry manure; Organic manure; Lisbon lemon; Growth; Double split

## Introduction

Seedling growth can be affected by inappropriate mineral nutrition, whether owing to a deficit or an excess. As a result, nutritional balance is required to allow plants to grow vigorously and better endure biotic and abiotic stress. Many studies have shown that poultry manure supplies all required nutrients, including micronutrients, and it has long been known to be a good source of plant nutrients [1]. Poultry manure also improves the physical, chemical, and biological characteristics of the soil by improving the soil's organic matter content, water holding capacity, oxygen diffusion rate, aggregate stability, and by reducing groundwater pollution [2&3]. found that applying 10-50 tha-1 of poultry manure improves soil physical qualities by lowering soil temperature and bulk density while increasing total porosity, making it a good source

of nutrients for sustainable crop production. The increased nutrient availability as a result of poultry manure application promotes crop growth and yield and also makes crops chemical-free, safer, healthier, and more delicious [4]. This study examines the effects of poultry manure in relation to crop growth and environmental health.

## Materials and Method

### Study crop

Lemon (*Citrus limon*; var. Lisbon), which has a lot of nutrients and health advantages, belongs to the Rutaceous family of flowering plants [5], and has been grown in tropical and temperate climates for about 2000 years [6]. The Lisbon lemon originated in Portugal

and was first grown in Australia in 1824. The Lisbon lemon is also popular in Argentina and Uruguay and other American states such as California and Arizona [7]. When mature, Lisbon lemons reach up to 15 ft and are bright yellow, with juicy, acidic flesh and few or no seeds [8&9] proposed that the Lisbon lemon variety was the result of a direct cross between sour orange (*Citrus aurantium* L.) and citron (*Citrus limon*). In Australia, the Lisbon lemon variety is the second most important lemon variety after Eureka, and it accounts for about 29 percent of Australia's total lemon production [7]. Lisbon lemon is quite similar to the Eureka lemon variety; however, Lisbon is thought to be thornier and produces its biggest crop in the winter. It is more cold-resistant and produces more fruit on the inside of the canopy, where it is protected from the wind [7].

## Experimental Procedure

A randomized complete block design (RCBD) with three replications was used. The study was carried out at the Organic Skill Acquisition Plot of the Federal University of Agriculture in Abeokuta (FUNAAB), Ogun State, Nigeria. The region has a bimodal rainfall pattern, with a long rainy season beginning in late March and a short rainy season lasting from September to early November following a brief dry period in August. The average monthly temperature during the time of the experiment (August - December 2019) was around 29°C, with a relative humidity of 80.98 percent and 72.5mm of rain. Treatments (0, 3.25, 6.5, and 13 kg/ha-1 of PM) were superimposed on already established two [3] year old Lisbon lemon seedlings budded on Cleopatra mandarin and planted at a spacing of 5m x 5m. More Lisbon lemon seedlings were procured from the National Horticultural Research Institute to replace the missing plant stands on the site. Cured poultry manure was

obtained from FUNAAB poultry farm. Poultry manure was applied as a double dose in ring form by digging a hole about 75cm away from the tree trunk on the 1st of August 2019 and 8th of October 2019 respectively. Before planting, samples of soil, as well as the chicken manure used in this study, were examined for their physical and chemical properties.

## Data Collection

Following the application of poultry manure to the field, seedlings were observed for two weeks. Weekly observations and records were made on the seedlings. Data were collected fortnightly on the plant height(cm), number of leaves, stem girth (cm), canopy diameter (cm), and leaf area (cm<sup>2</sup>).

## Data Analysis

All data collected were subjected to analysis of variance (ANOVA) and means were separated using Least Significant Difference (LSD) at 5% level of probability ( $P < 0.05$ ).

## Results

### Poultry manure analysis

(Table 1) showed that the pH of poultry manure used for this study was 7.20, which is neutral. The chicken manure contained 19.3 % organic carbon (C), with a carbon to nitrogen ratio of 23.6%. This C/N ratio value facilitated rapid composting and provided nitrogen in a form that was easily accessible. The poultry manure contained more potassium (1.62%) and total nitrogen (1.51%) than calcium (0.86%), Mg (0.74%), and P. (0.19%). The poultry manure also contained more Mn (227.3 mg/kg) than Fe (148.1 mg/kg), Zn (134.8 mg/kg), and Cu (32.4 mg/kg).

Parameters	Value
pH	7.20
Ca (%)	0.86
Mg (%)	0.74
K (%)	1.62
Na (%)	0.19
Organic C (%)	19.3
Total N (%)	1.51
C/N	23.6
P (%)	0.19
Mn (mg/kg)	227.3
Fe (mg/kg)	148.1
Cu (mg/kg)	32.4
Zn (mg/kg)	134.8

## Effects of poultry manure on the plant height of Lisbon lemon

The plant height of Lisbon lemon plants for 20 weeks after poultry manure application was shown in (Figure 1). The plant height increased with increasing rates of poultry manure. Lisbon lemon plants treated with 13 kg/ha-1 of PM produced the tallest

plants while the Lisbon lemon plants treated with 0kg (control) produced the shortest plants during this study. However, no significant effect was observed at 5% level of probability. The observed results of plant height prove that nutrients supplied by poultry manure are absorbed and used in subsequent growth, yield, and biochemical composition of the Lisbon lemon plants.

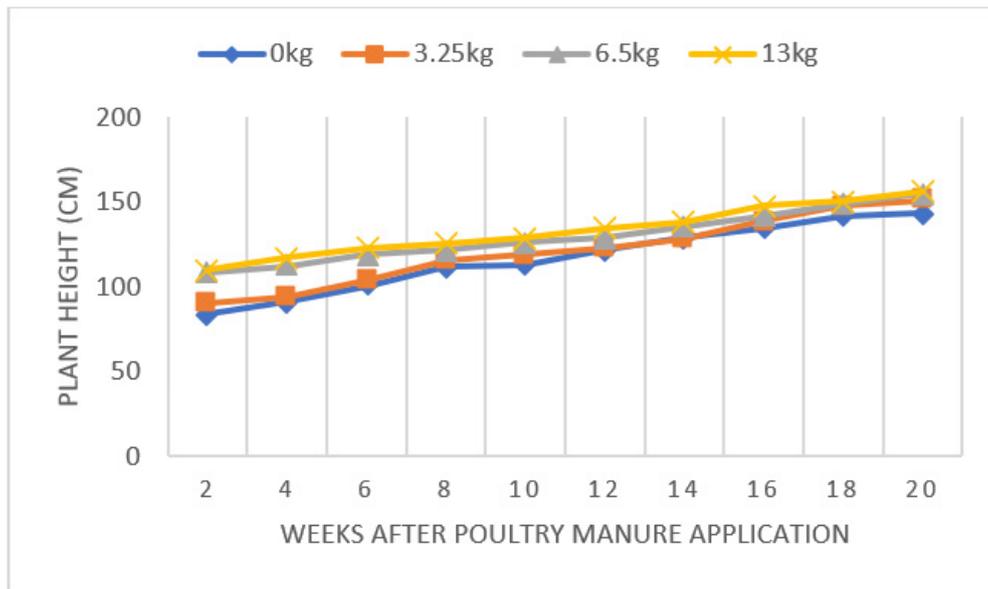


Figure 1: Plant height of Lisbon lemon cultivated on soil amended with poultry manure. (Significant at  $P < 0.05$ ).

**Effects of poultry manure on the number of leaves of lisbon lemon**

(Figure 2) depicts the number of leaves on Lisbon lemon plants 20 weeks after the application of poultry manure. With increasing rates of poultry manure, the number of leaves increased. The

number of leaves on Lisbon lemon plants treated with 13 kgha-1 of PM was the highest, while the number of leaves on Lisbon lemon plants treated with 0kg of PM was the lowest. There was a significant difference at 5% probability level in the number of leaves at the 20th week after poultry manure application.

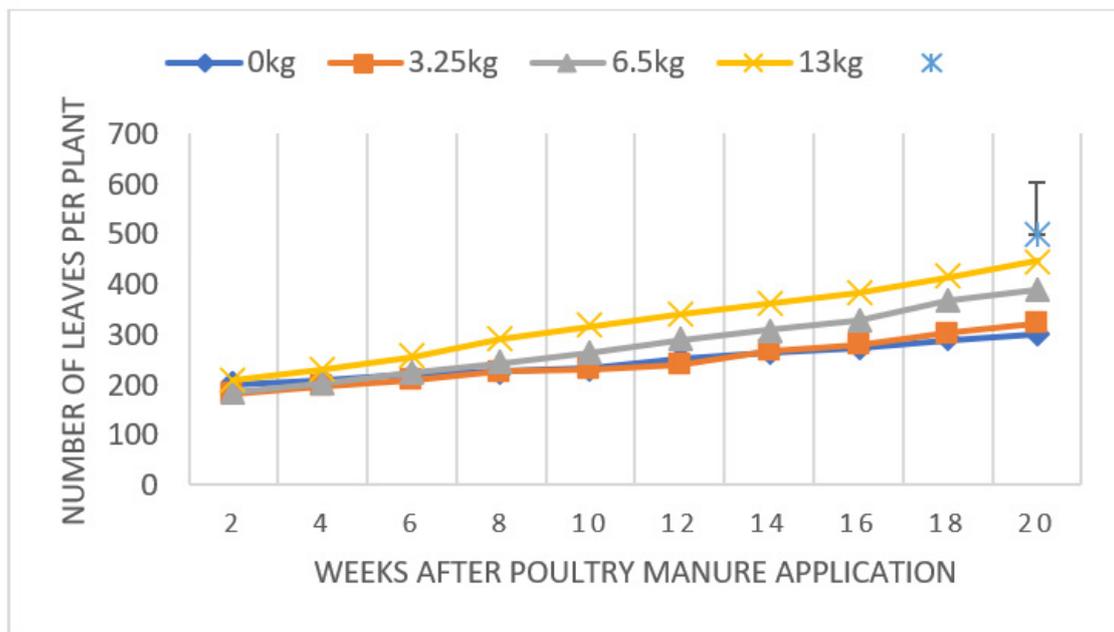


Figure 2: Number of leaves of Lisbon lemon cultivated on soil amended with poultry manure. (Significant at  $P < 0.05$ ).

**Effects of poultry manure on the stem girth of Lisbon lemon**

Significant differences were observed in the stem girth of Lisbon lemon plants at the 6th, 10th, and 12th week after poultry manure application at 5% probability level while no significant

difference was observed at other weeks after poultry manure application (Figure 3). The stem girth of the Lisbon lemon plants increased with increasing rate of poultry manure rates with Lisbon lemon plants treated with 13 kgha-1 producing the highest stem girth value while the control (0kg) produced the lowest stem girth value.

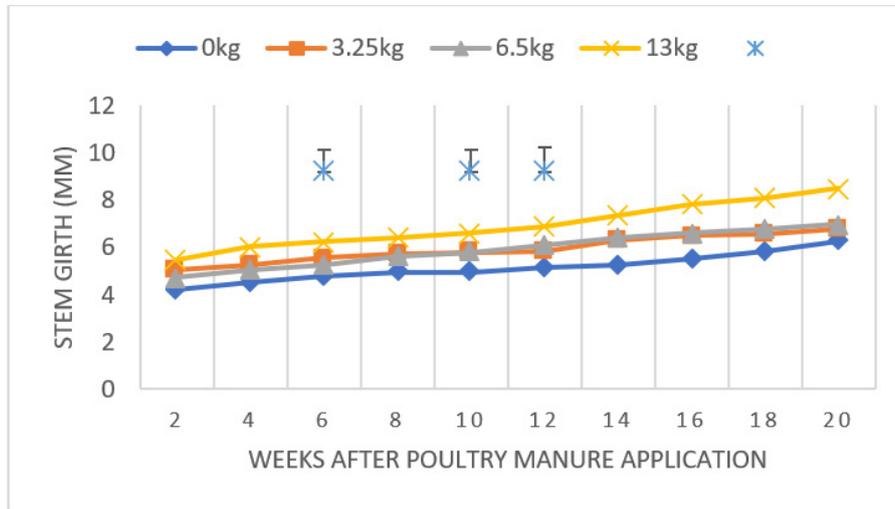


Figure 3: Stem girth of Lisbon lemon cultivated on soil amended with poultry manure. (Significant at P < 0.05).

**Effects of poultry manure on the canopy diameter of Lisbon lemon**

(Figure 4) shows that the canopy diameter of Lisbon lemon plants increased with increasing rates of poultry manure application. Significant differences in canopy diameter of the

Lisbon lemon plants from the 10th to the 20th week after poultry manure application were observed at the 5% probability level after the application of the second dose of poultry manure. The control (0kg) treatment resulted in the smallest canopy diameter, whereas the Lisbon lemon plants treated with 13 kgha-1 of PM resulted in the largest canopy diameter.

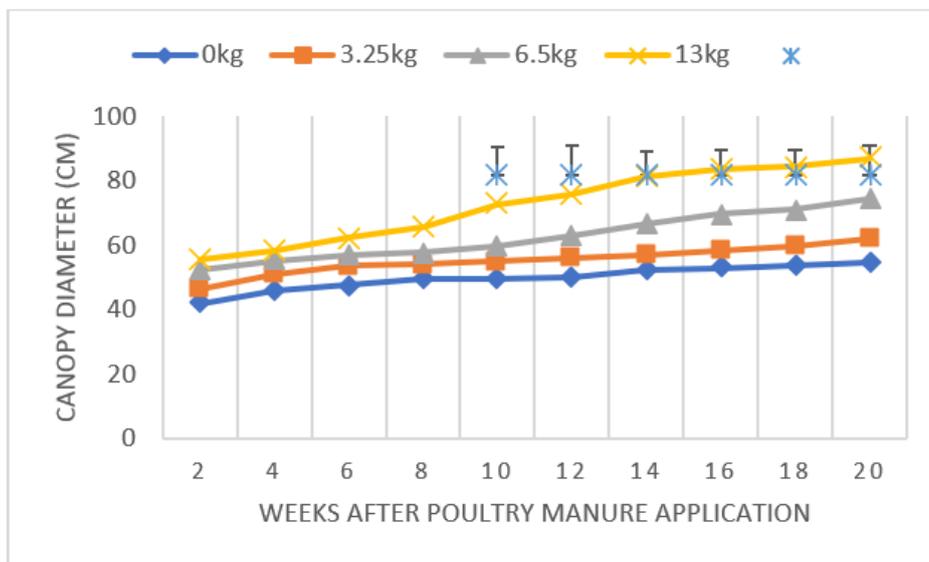
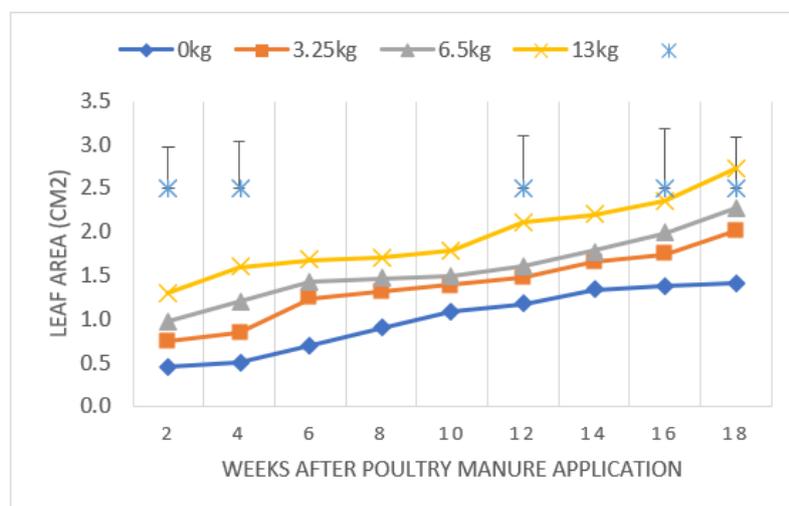


Figure 4: Canopy diameter of Lisbon lemon cultivated on soil amended with poultry manure. (Significant at P < 0.05).

## Effects of poultry manure on the leaf area of Lisbon lemon

(Figure 5) shows that the application of poultry manure had a significant effect on the leaf area of Lisbon lemon plants on weeks 2, 4, 12, 16, and 18, but had no effect on the leaf area of Lisbon lemon

plants on weeks 6, 8, 10, and 14. The leaf area of the Lisbon lemon plants increased as the rate of poultry manure increased, with 13 kg/ha-1 having the highest leaf area value and the control treatment having the lowest.



**Figure 5:** Leaf area of Lisbon lemon cultivated on soil amended with poultry manure. (Significant at  $P < 0.05$ ).

## Discussion And Conclusion

The results of this experiment show that, in addition to its numerous environmental and health benefits, poultry manure application promotes the growth of Lisbon lemon trees (*Citrus limon* var. Lisbon). The varying level of significance in some of the observed parameters is due, in part, to sample heterogeneity caused by resupplied missing stands of Lisbon lemon plants. This was also due to the relatively slow rate at which poultry manure decomposes before it can be used by plants [10].

In conclusion, the leaf area, canopy diameter, stem girth, and the number of leaves show significant differences at 5% probability level with 13kg/ha-1 having the highest value for all the observed parameters compared to other treatments. However, plant height for all treatments did not show any significant difference. The results depict that poultry manure application improves crop growth and mitigates environmental concerns. Hence, the 13kg/ha-1 poultry manure is recommended in terms of agronomic values and mitigation of environmental concerns.

## Acknowledgment

None.

## Conflict of Interest

No conflict of interest.

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