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Comparative Effects of Cow Dung and Poultry Manure on the Germination and Growth of *Zingiber officinale* (Ginger) William Roscoe Production

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Authors' contributions

This work was carried out in collaboration between both authors. Author OAO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author IOO managed the analyses of the study. Authors IOO and OAO managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

The study is based on determining the effects of organic manure (cow dung and poultry manure) on the growth & germination of *Zingiber officinale* using topsoil in the research as the medium of growth. The seeds were subjected to 7 treatments which include cow dung and poultry manures and topsoil only as control treatment. The seeds were sown directly into the polythene pots thoroughly mixed with the organic manures at different levels of application which includes 2.5 g, 5.0 g and 10.0 g with 3 replicates making a total of 21 poly pots. The germination was thoroughly observed for 3 weeks after planting. The experiment was laid in a completely Randomized design with 3 replicates.

The parameters assessed were the plant height, the number of leaves and stem girth. The data collected were subjected to ANOVA.

The Results of the study showed that treatment T1 with cow dung at 2.5 g had the highest plant height of (49.65 cm), stem diameter of (0.458 m) and Number of leaves (12.27) followed by T5

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(5.0g of poultry Manure) with plant height of (45.40 cm) stem diameter (0.435 cm) and number of leaves (12.73). Treatment 7 which is the control treatment had the Least Leaf Number of (24), height of (28.97) and stem diameter of (0.257).
Therefore from all the treatments used, cow dung at 2.5 g and poultry manure at 5.0 g are advisable for Raising *Zingiber officinale*.

Keywords: Comparative; effect; cow dung; manure; growth; ginger.

1. INTRODUCTION

The limitation imposed on the productivity of soil in the tropics, in term of loss of fertility and pressure of land use due to non-agricultural development, is forcing farmers to cultivate degraded or non-fertile soils. There is need to explore available means which could be used to improve the nutrient status of these soils. In a sustainable low input agricultural system, where nutrient depletion is a serious constraint to crop production, the use of organic manure is inevitable [1].

Hence, application of organic fertilizer is an important means of maintaining soil fertility status and is also environmental friendly. This is because nutrients contained inorganic manures are released more slowly and are stored for a longer time in soil, thereby ensuring a long residual effect [2]. Spices constitute an important group of agricultural commodities which have been used for adding flavor to food. Ginger consists of fresh or dry root of *Zingiber officinale*. The English Botanist William Roscoe (1753-1831) gave the plant the name of *Zingiber officinale* in an 1807 publication. The ginger family is a tropical group especially abundant in Indo-Malaysia, consisting of more than 1,200 plant species in 53 genera. The genus *Zingiber* includes about 85 species of aromatic herbs from East Asia and tropical Australia.

The name of the genus *Zingiber* is derived from a Sanskrit word denoting "horn-shaped" in reference to the protrusions of the rhizome. Some species are also used in pharmaceutical, perfumery, cosmetics and other related industries. Indian is one of the most leading spice producing and exporting countries in the world. In addition, large quantities of spice are consumed within the country for seasoning food and for several purposes. Spices are often the currency of the developing countries such as Asia, India, the improvement in agro-technique and the release of many intensive researches [3].

Ginger is grown as a monoculture and for its aromatic underground rhizome. Above ground the plant is a bamboo-like shrub but with softer leaves and stem.

It is a biennale plant, which need a lot of water, therefore ginger is planted in small basins, which are situated in small terrace at the mountain slopes. Elsewhere valleys are used, for an adequate irrigation.

Ginger does best on a sandy loam soil that drains well. Soils should be high in organic matter. Till the soil a month before planting, first spread about 30 m^3 of compost or manure. Plough to about 500 millimetres mixing the soil well then prepare the planting beds. This is normally done with a disc harrow working the soil into planting ridges where the ginger rhizomes are planted [4].

Ginger plant is of two types which includes the fresh ginger and the dry ginger. Fresh ginger and dry ginger are considered two different commodities; in fact, one author of an early [5] (Chinese herbal) felt that, they were so different that they must come from two different plants. The dry root is used to dispel pathogens via its ability to induce sweetening. It also expels cold, relieves nausea and clear away toxic matters [6] The dry root treats depleted yang, removes cold, useful for "cold" pain of the stomach and abdomen, it is also useful for diarrhea due to cold deficiency, cough, rheumatism and so on. Experimental data developed by a Chinese scientist verifies in the ability of the dried root to strengthen the stomach while acting as mild stomach and intestinal stimulant, it has been shown to inhibit vomiting. Studies with fresh root showed that for the first few hours, ginger tea reduce gastric secretions followed by a longer period of stimulation.

Zingiber officinale thrives in any soil provided it is well drained. It is valued as the best spice because it is used in cooking and baking for its

flavoring nature [7]. The characteristic odour and flavor of ginger is caused by a mixture of *Zingerone*, *Shogoals* and *gingerols*, volatile oil that compose of one to three percent of the weight of fresh ginger. Before eating, fresh ginger may be peeled and for storage, it can be substituted for ground ginger at a ratio of 6:1 although, the flavor for recipes such as ginger bread, cookies crackers, cake, ginger ale and ginger beer.

Ginger can be placed in plastic bag and refrigerated or frozen for longer-term storage. It can be used for preserving foods and it kills harmful bacteria. Indonesians frequently use spice paste based on the fresh chills and ginger to rub meat before grilling or baking commences which is also applied in some of our homes whereby we use ginger for steaming our meat, fish etc, before cooking to enhance the great, accurate and adequate taste of our meal.

1.1 General Objective of Study

To determine the effects of organic manure on the germination and growth of *Zingiber officinale*.

1.2 Scope of the Study

This experiment is focused on the effects of poultry manure and cow dung on the growth of *Zingiber officinale*.

2. MATERIALS AND METHODS

2.1 Area of Study

The experiment was carried out in Federal College of Forestry, Ibadan, Jericho, Oyo State, Nigeria beside the Visual, and now, Agricultural Technology.

2.2 Materials

The following are the materials used for the experiment. Ginger rhizomes, top soil, polythene pots, cow dung, poultry manure, veneer caliper, wheel barrow, watering can, 30cm ruler, exercise book and sieving basket.

2.3 Method of Preparation of the Poultry Manure and Cow Dung Mixture

The poultry manure was sun dried for one week; this is as a result of high nitrogen composition present in the manure which may be toxic to plants when added to it. This treatment was also applied to cow dung. The dried manure was later sieved and the fine dust was collected for the experiment. The level of application was 2.5 g, 5.0 g and 10.0 g.

The top soil was gotten from the *Gmelina* plantation in Federal College of Forestry, Ibadan and it was properly sieved in order to separate all unwanted materials contained in it. Later on, the top soil was measured into the polythene pots that constitute 21 pots; the weight of the soil used was 2.5 kg per pot and the size of the pots used were 25 cm by 10 cm.

2.4 Procurement of Rhizomes

The rhizomes of *Zingiber officinale* were procured from National Horticultural Research Institute (NIHORT). They were later bisected with a sterilized knife in order to avoid fungal attack on them.

2.5 Experimental Design

The experimental design (CRD) completely randomized design comprised of seven treatments with three replicates (See Table 1).

2.6 Parameters Assessed

a) Plant height (cm)
b) Stem girth (mm)
c) Leaf count

2.7 Method of Data Collection

The method of data collection adopted was duly on a weekly basis. About 30 cm ruler was used to measure the plant height and the stem girth was measured with a vernier caliper and the leaves were counted on a weekly basis.

2.8 Method of Analysis

The experiment is subjected to mean and analysis of Variance (ANOVA).

3. RESULTS AND DISCUSSION

3.1 Effect of Cow Dung and Poultry Manure on the Height of *Zingiber officinale*

Table 1 show that there is a significant difference among the treatments and the period of assessment (<.001) but, no significant difference in the interaction between treatments and the period of assessment at 5% level of probability (1.00 Ns).

Table 1. Experimental layout

T1	T3	T2	T5	T7	T6	T4
T2	T1	T4	T3	T5	T7	T6
T4	T2	T3	T1	T6	T7	T5

Ti = Cow dung 2.5 g, T2 = Cow dung 5.0 g, T3 = Cow dung 10.0g; T4 = Poultry manure 2.5 g, T5 = Poultry manure 5.02, T6 = Poultry manure 10.0a, T7 = Control

Table 2. Effect of organic manure on the height of *Zingiber officinale*

Treatments	1	2	3	4	5	6	7	8	9	10	Average
T1(2.5 g)	9.80	18.67	42.00	42.27	43.13	61.77	62.30	64.57	71.50	80.80	49.65
T2(5.0 g)	5.93	15.37	35.58	38.77	46.73	60.43	64.73	66.43	69.77	83.63	48.76
T3(10.0 g)	4.63	20.33	36.10	36.80	45.07	61.40	62.69	65.27	69.53	81.77	48.36
T4(2.5 g)	2.13	17.43	33.47	33.70	43.70	61.83	65.53	65.53	74.77	84.47	48.22
T5(5.0 g)	2.87	18.87	31.17	34.00	41.37	56.93	57.10	61.40	70.80	79.50	45.40
T6(10.0 g)	3.40	8.07	30.39	39.50	43.67	61.07	61.08	64.13	68.13	78.20	45.82
T7	0.00	2.47	11.97	20.17	26.67	38.80	38.81	41.50	48.13	61.17	28.97
L.S.D	6.928										
Grand Mean	45.02										
S.E	13.573%										
C.V	30.1										

Table 3. Effect of organic manure on the height of *Zingiber officinale*

	Weeks after planting										
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Average**
T1(2.5 g)	1.333	1.600	0.170	0.167	0.173	0.183	0.200	0.223	0.240	0.290	0.458
T2(5.0 g)	0.933	1.467	0.170	0.163	0.170	0.183	0.190	0.210	0.237	0.290	0.401
T3(10.0 g)	0.4771	1.633	0.180	0.160	0.170	0.180	0.187	0.223	0.243	0.293	0.376
T4(2.5 g)	0.900	1.500	0.167	0.157	0.167	0.183	0.203	0.223	0.240	0.290	0.403
T5(5.0 g)	1.267	1.500	0.160	0.160	0.170	0.180	0.187	0.210	0.230	0.230	0.395
T7	0.00	1.033	0.157	0.147	0.160	0.173	0.190	0.210	0.227	0.277	0.257
L.S.D	0.1120										
Grand mean	0.389										
S.E	0.2194										
% C.V	56.3										

Table 4. Effect of organic manure on the mean leaf production of *Zingiber officinale* seedlings

Treatments	1	2	3	4	5	6	7	8	9	10	Avg/M
T1(2.5 g)	0.33	2.33	6.33	6.33	9.00	11.33	16.00	19.33	24.00	27.67	12.37
T2(5.0 g)	0.00	1.67	5.00	6.69	10.00	11.33	14.33	18.00	22.00	26.00	11.50
T3(10.0 g)	0.33	2.67	6.33	7.67	10.00	11.67	15.67	19.33	24.00	28.00	12.57
T4(2.5 g)	0.00	3.67	6.67	6.67	9.00	11.00	16.33	20.00	24.33	28.33	12.60
T5(5.0 g)	1.00	3.67	8.33	7.00	9.33	11.00	16.00	19.67	23.67	27.67	12.73
T6(10.0 g)	0.67	2.00	6.33	6.33	8.67	10.33	14.67	18.33	22.67	26.67	11.67
T7	0.00	0.00	2.00	4.00	6.33	7.67	13.33	16.33	20.33	24.33	9.43
L.S.D	1.244										
Grand mean	11.82										
S.E	2.438										
%C.V	20.6										

Table 2 shows the mean height for all treatments at l0weeks seedlings with crow dung manure applied at 2.5 g (T1) recorded the highest mean height of 49.65 cm followed by T2 of 5.0 g with the mean value of 48.76 cm. T7 which is the control had the least performance with mean of 28.97cm which is in accordance with [8] who stated that natural fertilizers (Organic manures) are effective for the growth of plants and they can also be used in the place of artificial fertilizer. In the result of his experiment, cow dung at 2.5 g was recorded as the treatment with the highest growth performance followed by 5.0 g of poultry manure. However from my research findings this is proven to be correct and accurate in conclusion.

3.2 Effect of Organic Manure on the Mean Girth of *Zingiber officinale* Seedlings

Table 2 shows that there is no significant difference among the treatments and period of assessment but there is interactions between treatment and period of assessment at 5% level of probability (<.001).

Table 3 shows the means Girth for all the treatments at 10 weeks, Ti (Cow dung 2.5 g) had the highest means of 0.458 cm at 10 week after planting; followed by T5 (Poultry manure 5.0 g) having the mean value of 0.435 cm. T7 which is the control was recorded to have the least mean value of 0.257 cm. Therefore Cow dung and poultry manure are far better than ordinary topsoil, therefore the cow dung at 2.5 g is quite effective in promoting the formation of stem girth and can be useful in raising the seedling.

Table 3 shows that there is no significant difference among the treatments and period of assessment but there is interactions between treatment and period of assessment at 5% level of probability (<.001).

Table 4 shows the means leaf production for all the treatments. Poultry manure applied at 5.0 g (T_5) recorded the highest mean of 12.73 at 10 weeks after planting in the pots, followed by T_3 cow dung at 10.0 g with the means of 12.57 or 12.6 while T_6 poultry manure applied at 10.0 g and T_7 the control had the lowest mean of 11.7 and 9.43 respectively after 10weeks of planting. The poultry manure was quite effective followed by cow dung equally in promoting the leaf formation of the seedling and can be used for raising the seedling in line with [9].

4. CONCLUSION

From the above data, it is crystal clear that organic manure (cow dung and poultry manure) stimulate the growth of *Zingiber officinale* after it was planted into poly pots. The results presented in all tables, showing the mean leaf numbers, the height, the girth and its ANOVA, proves that cow dung and poultry manure significantly improved the seedlings and enhanced the growth rapidly.

Apart from cow dung at 2.5 g, (T_1) which gave the highest growth performance in both height yield and stem girth observed, the results show that higher concentration can also yield and promote the growth of seedlings. From the result obtained so far, I deduced that, with equal size of pots, (24 cm by 10 cm), lower concentration of organic manure applied to the plant which means that small quality is needed by the plants to thrive well.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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