

---

# Production of Improved Organic Fertilizer Using Animal Droppings

**Pet-Gospel Okoro, Peter C. Ukpaka, & Emmanuel Ehirim**  
Rivers State University,  
Port Harcourt  
[pescon2000@yahoo.com](mailto:pescon2000@yahoo.com)

---

## **Abstract**

*The importance of fertilizers cannot be underscored owing to their positive impacts on plants, environment and human health. However, the use of growth and yield enhancers such as NPK fertilizer have been intensively discouraged as the effects on the environment and human health have been devastating. However, the global awareness of the hazardous effects of chemical fertilizer is prompting more and more farmers shifting to organic fertilizers. The gap created by the use of chemical fertilizers prompted the production of improved organic fertilizer using animal droppings and other organic structures. The production is a composite of about five different organic compounds with inherent and sufficient supply of plant required micro and macro nutrients, the choice of materials include poultry droppings, swine droppings, blood meal, bone meal and wood ash while the factors necessitating the choice of materials include availability, affordability and efficiency. Application result indices using the product, NPK fertilizer and Control indicated good performance of the product with respect to yields, plants growth, natural tastes of crops, low decaying rates, water and nutrient retention, etc., as the improved organic fertilizer is aimed at exterminating the environmental and health effects of chemical fertilizers for enhanced organic farming.*

---

## **1. Introduction**

Man and animals depend on plants for good health, while the plants solely rely on the nutrient deposits in the soil for sustainability, before the advent of technology or development, farming was rotational where a piece of land is cultivated and allowed to fallow for about seven years, however, development and all its attributes motivated the much utilization of the available land for various economic purposes other than farming and this as a matter of fact resulted in the drastic reduction of arable farm land, hence the very few available arable lands in most parts of Nigeria are no longer allowed to fallow naturally.

The essence of technology in every human endeavor is aimed at proffering scientific solutions to almost every human problem; hence within the context of this work, alternative soil nutrients was developed to artificially supply the deficient nutrients required by the plants under a compound name “ FERTILIZER”. The word fertilizer is defined in different ways by different authors as” Any natural or chemical substance, especially nitrogen, potassium, salts or phosphates, that is added to or dug into soil to improve the yield, size or quality of plant, especially food crops<sup>[6]</sup> or an alternate nutrients artificially made and produced in an organized form for the supply of required amount of nutrients as required by individual plants for healthy growth and good yields.

**Fertilizers are known to be of Two Major Categories, viz:**

1. Organic fertilizer
2. Inorganic / Synthetic fertilizer

The current environmental degradation of the use of synthetic fertilizer is most worrisome as the human health effect of the consumed synthetic farm products is on the increase. Though successive applications of chemical fertilizers can have a detrimental effect on the land by depleting ingredients essential to maintain the water holding capacity, soil structure and earthworm capacity whereas chemical fertilizers give an initial boost for plants, often they do not last throughout the growing season and generally do not contain trace elements. Organic fertilizers on the other hand put life back into the land by providing both short and long term benefits with a balanced mix of important nutrients and naturally occurring trace elements vital for healthy plant growth <sup>[9]</sup>.

Good health is basic for the quality of life of everyone, but the recent incessant minor and major ailments such as allergies, food tolerance, early puberty, cancer, heart and kidney failures, liver problems, infertility, diabetes, degenerative diseases, antibiotic resistant bacteria, etc are on the increase with little or no medical solutions.

## **2. Materials and Methods**

### **2.1 Materials**

**Manure** is organic matter, mostly derived from animal feces except in the case of green manure, which can be used as organic fertilizer in agriculture. Manures contribute to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil. It contains higher organisms that feed on the fungi and bacteria in a chain reaction that includes the soil food web. It is also a product obtained after decomposition of organic matter like cow dung which replenishes the soil with essential elements and adds humus to the soil. <sup>[2]</sup>

### **2.2 Certified Organic Fertilizers Production**

Blood meal, bone meal, and other animal by-products are permitted in certified organic production as soil amendments, though they cannot be fed to organic livestock. Blood meal is different from bone meal because blood meal contains a higher amount of nitrogen while bone meal contains phosphorus. Alternatives to Blood Meal include feather meal and alfalfa meal. Blood meal is sometimes used as a composting activator.

### **2.3 Choice of Materials**

Materials used in the production of improved organic fertilizer were based on some factors such as:

- ❖ Material availability
- ❖ Cost effect
- ❖ Strength of material (Nutrient contents)

Base on the above factors, the following materials were selected to achieve the purpose of the production and the materials include:

1. Bone (Steamed) Meal
2. Wood Ash
3. Poultry droppings
4. Blood meal
5. Swine Droppings

The choice of the materials was based on some factors deemed very essential in terms of raw material availabilities, quality plant nutrient values, product commercialization, cost effectiveness, enhanced safe guard of the ecosystem, etc. Considering the fact that most chemical fertilizers in the market are produced to meet the demand of farmers for various crops,

likewise the selected materials for this production are such that could ensure very good production of nutrient cohesiveness and farmers all -in – one product for both cash and foods crops.

### **Poultry Droppings**

The poultry droppings/ manures used in this work are undiluted dried materials collected from various pens / poultry farms that obviously contain all the 13 essential plant nutrients that are used by plants, that includes nitrogen (N), phosphorous (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), manganese (Mn), copper (Cu), zinc (Zn), chlorine (Cl), boron (B), iron (Fe), and molybdenum (Mo).

**Poultry Dropping** is the faeces of chickens used as an organic fertilizer, especially for soil low in nitrogen.<sup>[3]</sup> It has the highest amount of nitrogen, phosphorus, and potassium. Poultry dropping is sometimes pelletized for use as a fertilizer<sup>[11]</sup>, and this product may have additional phosphorus, potassium or nitrogen added. One chicken produces approximately 8-11 pounds of manure monthly.

### **Blood Meal**

**Blood meal** is a dry, inert powder made from blood used as a high-nitrogen organic fertilizer and a high protein animal feed<sup>[10]</sup>. It is one of the highest non-synthetic sources of nitrogen<sup>[7]</sup>. It usually comes from cattle or hogs as a slaughter house by-product.

### **Bone Meal**

**Bone meal** (or **Bone manure**) is a mixture of finely and coarsely ground animal bones and slaughter-house waste products.<sup>[1]</sup> It is used as an organic fertilizer for plants and as a nutritional supplement for animals. As a slow-release fertilizer, bone meal is primarily used as a source of phosphorus and protein. Finely ground bone meal may provide a quicker release of nutrients than the coarser ground version of bone meal.

### **Wood Ash**

Wood ash is the inorganic and organic residue remaining after the combustion of wood or unbleached wood fiber on the average woos ash of about 6-10% ashes depending on the type of wood and can be used as organic fertilizer<sup>[5]</sup>. When ash is produced in industrial combustion systems, the temperature of combustion, cleanliness of the fuel wood, the collection location, and the process can also have profound effects on the nature of the ash material<sup>[8]</sup>. Therefore, wood ash composition can be highly variable depending on geographical location and industrial processes.



**Fig. 2 .1:** Wood ash from a campfire

Many studies have been conducted regarding the chemical composition of wood ash, with widely varying results, some quote calcium carbonate ( $\text{CaCO}_3$ ) as the major constituent,<sup>[4]</sup> others find no carbonate at all, but calcium oxide ( $\text{CaO}$ ) instead. Some show as much as twelve percent iron oxide while others show none.

However, most fertilizers are categorized by a conventional nutrient formula of N-P-K --- (2.1)

As earlier stated above, the N-P-K ratio is always dependent on the intent of the producers with respect to crop growth and yield, though, the micro nutrient levels of most NPK fertilizers seems to be on a high level, hence the aim of this work is to produce a product of appropriate micro and macro nutrients levels.

## 2.5 Determination of Nutrient Rates

In the formulation, some of the relations and definitions used to explain the role of components in the composition are as follows:

### Percentage Concentration

In such a component mixture, the concentration of a molecular species can be expressed as:

#### a). Mass Concentration:

The mass concentration of the species A, designated as  $\ell_A$ , is defined as the mass of A per unit volume of the mixture. i.e  $\ell_A = \frac{M_A}{V}$  --- 2.2

where  $M_A$  is the mass of species A, and  $V$  is the volume of the mixture. In total mass concentration or density  $\ell$ , is the total mass of a mixture contained in a unit volume.

$$\ell = \sum_{i=1}^s \ell_i \quad \text{--- 2.3}$$

where  $i$  is the number of species in the mixture.

#### b). Molar Concentration

The molar concentration of species A denoted by  $C_A$ , is defined as the number of moles of species A per unit volume of the mixture. i.e  $C_A = \frac{n_A}{V}$  ---- 2.4

Where  $C_A$  is the molar concentration of species A, and  $n_A$  is the number of moles of species

The mass and molar concentrations are related in that form. i.e  $C_A = \frac{\ell_A}{M_A}$  .... 2.5

Where  $M_A$  is the molar mass (or molecular weight) of species A. The total moles concentration  $C$ , is the total number of moles of all species I, contained per unit volume of the mixture.

$$C = \sum_{i=1}^s c_i \quad \text{-- 2.6}$$

## 2.4 Fertilizer Production

The materials considered in this production are viewed to have high macronutrients and micronutrients/trace elements. However, the choice of materials and type of intended product is a determining factor in deciding on which formula to use in the production of an organic

fertilizer. Organic fertilizer just like inorganic fertilizers varies in nutrient composition depending on the choice of the producer.

Some of the equipment required for production of organic fertilizer are not be limited to the followings:

1. Dryer
2. Grinder
3. Mixer
4. Weighing balance, etc

#### **2.4.1 First Step of production- Drying of Components**

The process of the fertilizer production includes gathering and preparation of materials required for the production, part of the first process entails subsection of some collected quantities of poultry and swine droppings from poultry and piggery farm houses respectively into a rotary drying machine. Naturally, both materials contained some moistures which was dehydrated at a controlled temperature not exceeding 35<sup>o</sup>c. Also, raw blood meal collected from an abattoir was subjected to same low temperature heating process as to inhibit loss of the nutrient value, like wise bones collected from same abattoir were steamed at same controlled temperature of about 35<sup>o</sup>c to ease material grinding.

Moreso, some quantities of saw dust were collected from a saw meal and were subjected to a combustion system thereby converting the saw dust into a usable wood ash at a combustion temperature not exceeding 35<sup>o</sup>c.

#### **2.4.2 Step Second – Material Processing**

With the aid of a weighing balance, all the processed components were gathered and scaled at various and appropriate mass weights considered essential in achieving the desired objectives of the organic fertilizer production, the scaled components were then subjected to a grinding machine and thereafter a mixer for a homogenous mixing.

#### **2.4.3 Step Three- Material Sampling and Field Applications**

Samples of the produced organic fertilizer were sampled and sent to a laboratory for chemical analysis of the various nutrient values in comparison with NPK fertilizer and other organic fertilizers and later subjected to a field application test for verification of performance strength.

### **3. Results and Discussion**

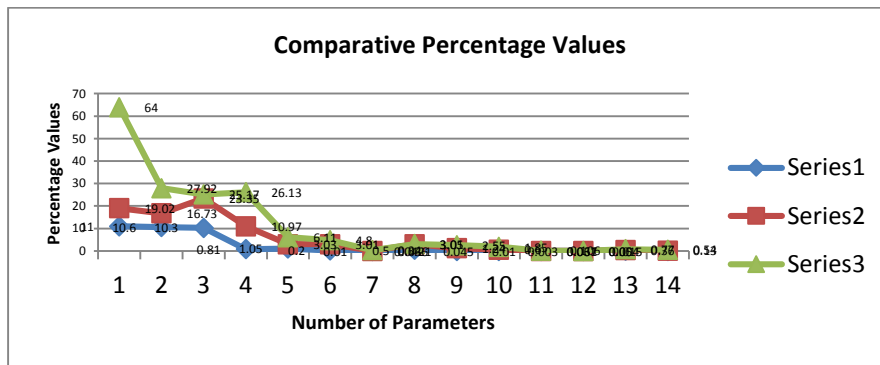
The application of the product alongside with a chemical fertilizer and a control shows some significant performance on the plants used in the demonstration and considering their individual overall performance on the crops used in the work.

**Table 3.1:** Nutrient composition of experimental work and recommended percentage values

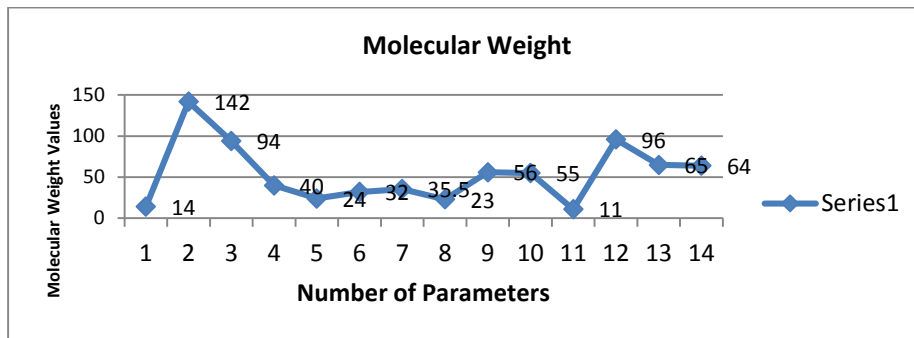
S/n	Components	Recommended % Values	% Nutrient Composition	Molecular Weights	Wt. of Each Component	No. of Moles of Each Component	Wt. Fraction of Each Component
1	N	11-64	19.02	14	3.27	0.054	0.23
2	P <sub>2</sub> O <sub>5</sub>	10.6 - 27.92	16.73	142	29.15	0.477	0.21
3	K <sub>2</sub> O	10.3 - 25.17	23.35	94	12.65	0.207	0.14
4	Ca	0.81 - 26.13	10.97	40	11.46	0.188	0.29
5	Mg	1.05 – 6.11	3.03	24	0.89	0.015	0.04
6	S	0.2 – 4.8	3.01	32	1.18	0.019	0.04
7	Cl	0.01 - 0.34	0.036	35.5	0.02	0.000	0.0000
8	Na	0.50 – 3.05	3.01	23	0.85	0.014	0.04
9	Fe	0.0421 – 2.55	1.24	56	0.85	0.014	0.015
10	Mn	0.045-1.85	0.6	55	0.41	0.007	0.007
11	B	0.01 - 0.061	0.037	11	0.005	0.000	0.000
12	Mo	0.003 – 0.05	0.004	96	0.005	0.000	0.000
13	Zn	0.106 – 0.77	0.36	65	0.29	0.005	0.004
14	Cu	0.015 – 0.54	0.13	64	0.1	0.002	0.002
	TOTAL		81.53	761.5g	61.13g	1	1



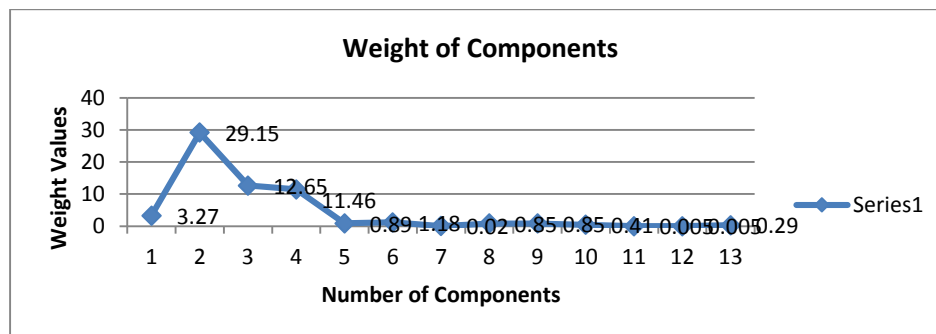
**Plate 3.1:** Sample of Improved Organic Fertilizer



**Fig.3.1: Comparative Percentage Nutrient of all Components**



**Fig.4.2: Molecular weights of each component**



**Fig. 3.3: Weights of each Component**

Just about two crops (Pumpkin and maize) were used for the trial test that lasted for nine weeks of close observation from date of planting. Control measures were equally used to determine the efficacies of each treatment, each of these treatments were:

- ❖ OOF – Opulence Organic Fertilizer
- ❖ NPK- Nitrogen phosphate potassium Fertilizer
- ❖ CTL – Zero / Blank Treatment.

A close observation technique was employed to examine the individual performance for effective and analytical comparison using T-test (LSD) @  $P < 0.05$  level. Various parameters were put into consideration such as the Width of the leaves, the rate of plant growth, the different plant colors at different times, the number of leaves on each plant per time, the differences in stem sizes, the plant height measurements, etc. After harvesting, another measure was also taken to consider the various yields.

However, the soil of Bori was used in the field application and observed to be respondent to treatment, and for crop like Pumpkin and Maize, the obtained results were impressive and



suffice to note that the influence of the plant treatment by Opulence Organic Fertilizer (Improved Organic Fertilizer) was very recommendable compare to other treatments {NPK and Zero application} The result of NPK application to maize witnessed an average growth and height of plant, moderate leaf color, sizeable plant stem and leaves. In comparison with zero application, it was observed the soil was void of necessary plant nutrients, hence resulted in its poor performance. The use of Opulence Organic Fertilizer for treatment no doubt was very impressive in all the parameters considered which includes, good plant growth and height, excellent dark green color, good stem sizes, the good yield after harvest indeed made it outstanding. The use of Opulence was so pronounced and very significant in enhancing to no small measure good growth and yield of both crops.

#### 4. Conclusion and Recommendation

Agricultural studies show time and time again that the key to a healthy garden is soil teeming with microscopic life, the acids in chemical fertilizers can kill these essential micro-beings. In contrast, organic fertilizers support them, there are no substances present in an organic fertilizer that can adversely affect or hinder microscopic life and this is why organic fertilizers are proved not only beneficial to plants but to the micro organisms found in soil as well. In conclusion, Opulence organic fertilizer is environmentally friendly, it does not scorch plant even when applied directly to the roots, it is mild and safe to handle and does not have any known biological effects, and its supply of chlorophyll was observed to be very efficient. It is very good for soil aeration and has capacity to absorb water for the plant's requirement. The discovered disadvantages of organic fertilizer are that it may require extra time/labor for application and resurfacing of soil round the plant before application. ,

Despite the importance of the subject, adequate research into the relationship between agriculture and health has been lacking, hence it is of my splendid pleasure welcoming the government's Local-Content Initiative in terms of encouraging organically produced farm products by proposing the following recommendations: -

- Intensive work on the evaluation of the chemical content of some of the chemically grown foods
- A program of intense research into the health effects of modern food processing.
- Investment in the development of organic food and farming.

#### 5. References

- Ananda S. Presad. (2005). WHC – Trace elements In Nutrition, Health And Diseases: Zinc And Cell Mediated Immunity. pp 6
- Barrett, J. (2008). FCS Soil Science L3. FET college series. Pearson Education South Africa. p. 70
- Brain Rees: Newsletter From USA Food A Drug Administration: Health 'n' Energy. Obtained From <http://www.health-energy.com/Editorials/editorialpoison.htm>
- Chapman, H.D. (Ed.) 1966. Diagnostic Criteria for Plants and Soils. Univ. California, Office of Agric. pp.794
- Deborah L. Martin; Grace Gershuny, eds. (1992). The Rodale Book of Composting: Easy Methods for Every Gardener. pp. 126
- David Suzuki. (2004). Soil, Plant, People And The Environment. pp 7 – 9
- Etiegni L, Campbell AG (1991). "Physical and chemical characteristics of wood ash". Bio resource Technology, pp173
- E. Tielemans. (1999). Pesticides Exposure A d Decreased Fertilization Rate In Vitro: The Lancet, Vol.7: 354 (Journal)
- King'ori, AM; Tuitoek, JK; Muiruri, HK (1998). "Comparison of fermented dried blood meal



and cooked dried blood meal as protein supplements for growing pigs.”Tropical animal health and production., pp.191

Lan Perry. (2002). Benefits Of organic fertilizer. pp 10 – 12

Telkamp, Mick. "The Straight Poop On Using Chicken Manure as Fertilizer". February 2015. Pp.12