



# Training Report on the Production of biofertilizer

Youth trained to produce biofertilizer to drive EBA approaches and bring climate action to scale



## Context

With [over 70 million](#) hectares of arable land, Nigeria fertilizer demand stands at over 6 million tonnes each year, with a reported [63% increase](#) annually. Nigeria [represents](#) the largest fertilizer market in the ECOWAS region, accounting for up to 45% and imports most of its fertilizer. An average of [over \\$100 million](#) is expended each year importing fertilizer. Human [food chain toxicity](#) has been shown to be influenced by application of inorganic fertilizers. In addition, use of inorganic fertilizers to improve fertility has been [reported](#) to also be ineffective – especially in parts of Northern Nigeria. This is primarily due to risks including declined soil organic matter content, soil acidification, and degradation resulting to increased soil erosion. The detrimental effects of inorganic/chemical fertilizers cut across human and environmental health. While the use of chemical fertilizers has their place in increasing plant nutrients in adverse weather conditions or during times when plants need additional nutrients, their over use has several harmful effects. [Chemically produced plants will accumulate in the human body, toxic chemicals, which are very dangerous](#). The deleterious effect of the chemical fertilizers starts from the manufacturing of these chemicals, whose products and by-products constitute toxic chemicals or gases like NH<sub>4</sub>, CO<sub>2</sub>, CH<sub>4</sub> etc. which cause air pollution. When the waste from the industries is disposed-off untreated into nearby water bodies, causes water pollution. It also includes the most devastating effect of chemical waste accumulation in the water bodies i.e., water eutrophication. And when added in soil, its continuous use degrades the soil health and quality while polluting it.

On the flip side, use of organic fertilizer has been shown to [increase yields](#) by 447kg per hectare, in addition to being more affordable. Studies show that [mixing](#) organic fertilizer with the most abundant inorganic fertilizer nitrogen (N), phosphorus (P) and potassium (K) popularly referred as NPK, yields the most positive results. A [mixing ratio](#) of 1 part inorganic and 3 parts organic, stands out as the most optimal. The implication is, the organic/biofertilizer and inorganic/mineral fertilizer markets are mutually reinforcing. This mutuality provides a timely market for organic fertilizer production in Nigeria and is backed by robust policy and regulatory frameworks.

On the policy front, Nigeria ratified its commitments to the Paris Climate Change Agreement – popularly known as the Nationally Determined Contributions (NDCs). Among key areas prioritized include sustainable agriculture – where organic fertilizer is a key aspect. The Agricultural Promotion Policy, with its transformational Presidential Fertilizer Initiative (PFI), offers the most direct policy backing for local fertilizer production in Nigeria. Through PFI, a total ban on importation of all NPK fertilizers, which are now to be blended locally, has been effected and this is expected to save the government [over \\$500 million](#) a year in foreign exchange. The trickle down effects in cost savings of [over 2000 Naira](#) compared to imported fertilizers, a [300% increase](#) in local production capacity, as well as [over 250,000](#) in direct and indirect jobs are in the offing. On the regulatory front, Nigeria is among few countries with a [biofertilizer standard](#) that ensures all locally produced biofertilizer is registered and standardized. This is the Biofertilizer Registration Regulations 2019, offered by the National Agency for Food and Drug Administration and Control (NAFDAC). Cumulatively, growth of a local fertilizer industry in Nigeria provides opportunities for expansion of biofertilizer as a critical complement to optimal use of fertilizers in the country.

This training came as a timely undertaking to equip youth to seize enterprise opportunities in Nigeria's growing domestic fertilizer sub-sector, while contributing to optimal implementation of key climate and development policy & regulatory provisions – including the NDCs, the Agricultural Promotion Policy & PFI as well as the biofertilizer regulations.

## **Introduction**

On 31<sup>st</sup> of August 2020 to 3<sup>rd</sup> September 2020, willing Innovative Volunteerism Youth actors for Climate Action under the Youth climate action solutions enterprise called EBApreneur solutions Nigeria undertook a training in bio-fertilizer making. The objective of the training was to equip youth with skills in producing bio-fertilizer as a climate action solution to bring Ecosystems-based Adaptation (EBA) to scale as they serve the community as well as leverage on it as an income & wealth creating opportunity both for the youth and the agro-value chain actors. The training was done in a day. Three youth undertook the training and equipped to train others while also producing the biofertilizer to serve the community. The training was conducted by Mohammad Chapa of chamraq fertilizer and Biogas Company a local bio-fertilizer dealer and trainer.

## **Program of training**

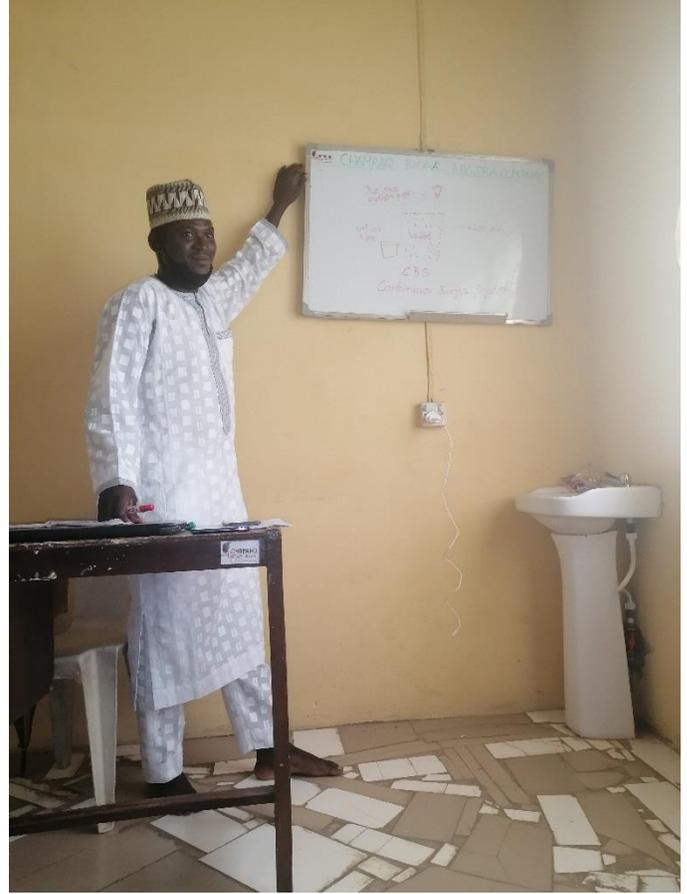
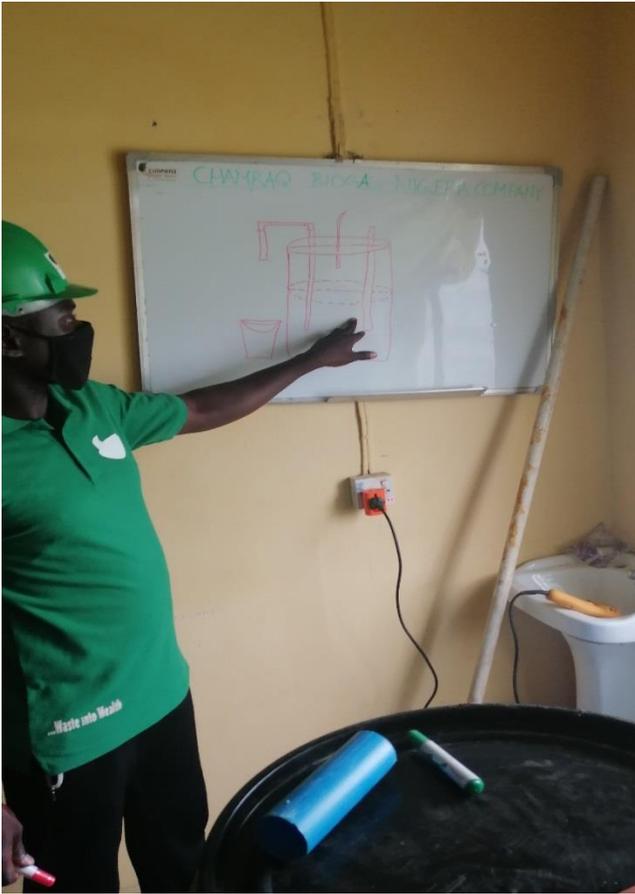
The training covered both the theoretical and practical aspects of biofertilizer production using locally available materials and components.

## **Theory**

The theoretical aspect of biofertilizers we were trained on covered: its importance, components and mode of production.

The name itself is self-explanatory. **Biofertilizer** is a ready-to-use live formulation of such beneficial microorganisms which on application to seed, root or soil, mobilize the availability of nutrients by their biological activity. They help build up the soil micro-flora and there by the soil health. As we know, organic farming excludes the use of any

chemical. Use of bio-fertilizer is recommended for improving the soil fertility in organic farming.



***Facilitators of the biofertilizer training lecturing innovative volunteerism actors during the theory session***

Bio-fertilizers are substances which contains living microorganisms which when applied to seeds, plant surfaces or soil, colonize the interior of the plants and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Bio fertilizers add nutrients through the natural process of nitrogen fixation, solubilizing phosphorous, and stimulating plant growth through the synthesis of growth promoting substances. The microorganisms in bio fertilizers restore the soil's natural nutrient cycle and build soil organic matter. Through the use of bio fertilizers, healthy plants can be grown while enhancing the sustainability and the health of the soil. Bio-fertilizers can be expected to reduce the use of synthetic fertilizers and pesticides but are not yet able to replace their use.



### ***Innovative volunteerism actors during the biofertilizer training***

During the training we are made to understand that there are many benefits to using this safe and relatively inexpensive product. It produces a healthier crop and promotes subsistence farming. Biofertilizers are an environmentally friendly substitute for harmful chemical fertilizers. They transform organic matter into nutrients that can be used to make plants healthy and productive. They have a low production cost because they make use of leftover vegetables, cow dungs, poultry waste and easily obtained organic materials such as rice husks, bamboo, and vegetables that can be found in even the most remote areas.

### **IMPORTANCE OF BIO-FERTILIZERS**

1. They are means of fixing nutrient availability in the soil. Generally, nitrogen deficiencies.
2. Since bio fertilizers are technically living due to the presence of microorganisms, they can symbiotically associate with plant roots. Involved microorganisms could readily and safely convert complex organic materials into simple compounds so that they are easily taken up by the plants. The function of the microorganisms is in long duration causing an improvement in the fertility of the soil.
3. They increase crop yield by 20-30%, replaces chemical nitrogen and phosphorous by 30% and stimulates plant growth.
4. They help to provide protection against drought and some other soil-borne diseases.
5. They advance shoot and root growth of many crops.
6. To produce a larger quantity of crops, bio-fertilizers with the ability of nitrogen fixation and phosphorous solubilizing would lead to the greatest possible effect.
7. They help to promote healthy soil, leading to greater farming sustainability.
8. They are cost effective

9. They reduce the risk of plant diseases
10. They do not cause any type of pollution as they are eco-friendly

### Practical training

We were also taught hands on how to produce biofertilizers through a biodigester.

A biodigester is a system which receive organic matter, which decompose in a digestion chamber. The digestion chamber is fully submerged in water, making it an anaerobic environment. The anaerobic environment allows for microorganisms to break down the organic material which will then be received as fertilizers and converts the gas it into biogas. The first step in the manufacture of biofertilizer using the method we were trained on, is the construction of a biodigester as a core piece of equipment.



*Diagram explaining the working principle of a digester*



*a continuous biodigester system constructed during the training*

<https://drive.google.com/file/d/1WUXEc9kONFg8MEZVQCvmAtI8jYpib4DX/view?usp=drivesdk>

<https://drive.google.com/drive/folders/1W8gyRAWL8hg9ncvSonwcMiaceYwBfACH>

### Material listing for biodigester system

- 50-gallon drum with a removable lid container
- Feed tube
- Drain valve
- Plastic tube
- ¾ inch PVC
- 3/8 inch copper pipe
- 90 degrees elbow
- T-fittings
- Kegs

### Material listing for biodigester system

For the purpose of this training, only cow dungs was used, with a mixture of yeast, potassium solubilizer and Dadawa (locust beans) as booster microbes to catalyze the breaking down, but generally materials for biofertilizer production includes.

- Animal manure: cow dung, chicken manure, sheep manure, horse dung etc.
- Kitchen waste and household garbage
- Municipal sludge
- Agricultural residue

### Biodigester construction

An airtight batch anaerobic bio-digester was fabricated using hand tools at the training center. The theory behind was simply downward delivery of biogas and upward displacement of water. The biodigester consists of digestion chamber, inlet from the top cover, digestates outlet pipe, sampling point and a stirrer.





### **Bio-fertilizer production procedure**

Cow dung was collected in a waterproof sack from cattle market at Minna, Niger state-Nigeria respectively. The raw materials were pretreated by removal of the unwanted non-biodegradable. In addition, cow dung was sun dried for 3 days. Twenty kilograms (20 kg) of the biomass (cow dung) was measured using analogue weighing balance and thoroughly mixed. The resulting mixture (i.e. 20 kg of biomass) was mixed with required amount of water to obtain the feedstock. The dilution of the biomass was to enable bacteria move freely in the bio-digester. The feedstock was homogenized for easy digestion and its physicochemical and microbiological parameters were analyzed before charging into the bio-digester. Twenty kilograms (20 kg) of the feedstock were fed into the bio-digester through the top opening cover and closed after charging: airtight condition of the digestion process was ensured. The feedstock occupied 79% of the bio-digester volume leaving a clear space of 21% for expansion/biogas production. The digester and its content was allowed to ferment for 5 days at atmospheric conditions.



*Cow dung & water being stirred to be fed into the digester fermentation*



*biodigester fed with biomass waiting*



## Conclusion

This training afforded us the opportunity to gain new knowledge and skills that would improve us as individuals, retooled our skills and provide an avenue to improve our livelihood as well as that of other youths, farmers and the society at large. The changing climate has opened our eyes to see that Environmental stresses are becoming a major problem and as a detrimental consequence of the effect, productivity of crops is declining at an unprecedented rate. Our too much dependence on chemical fertilizers and pesticides to quench the huge demand of food by growing populations has encouraged the industries to produce life-threatening chemicals as a form of

pesticides or fertilizers which are not ecosystem-based adaptation friendly. These chemicals are not only hazardous for human consumption but also severely affect ecological balance in the environment. In this adverse situation, biofertilizer are a potent alternative that not only can feed the emerging population but also can save the agriculture from the severity of various environmental stresses. It is therefore, required to realize the various important and beneficial aspects of biofertilizers and implementation of its application in modern agriculture and value addition. Although biofertilizers possess a great potential to enhance the productivity of agricultural lands tremendously, the integrated approach to determine the most favorable plant microorganism interaction is the most crucial factor that results the augmentation in productivity. This biofertilizer training provide an opportunity for socio-professional reorientation and economic and financial achievement for the youths in Nigeria. The team appreciated and is ready to execute the skills acquired during this training. The development of bio-fertilizers will help farmers replace chemical fertilizers with organic fertilizers. This biofertilizer will be used to improve soil structure and water retention capacity. This bio-fertilizer will help nurture the soils as well as reduce the chemicalized inputs which alters soil functioning as well as contributes to unsafe food. These actions are crucial as they will help to drive the implementation of Nigeria's climate commitments – i.e. its NDCs – but in a novel way that brings in youth as solutions providers and unlocking income opportunities for them. This will also simultaneously drive the optimal implementation of critical complementary policies – including the PFI and the biofertilizer standard.

### **Next steps**

With this new knowledge gained in the production of biofertilizer, the next practical steps include:

- commence the test application of the biofertilizer on soils, seeds, roots, tubers etc. and engaging other actors in the sector to adopt the use of biofertilizer in their agricultural system and processes.
- map out off-taker farms to be our early adopters of EBApreneur Solutions Nigeria bio-fertilizers. This will include rural farmers, individual farmers, cooperatives, and communities for the switch from harmful chemical fertilizers to an ecosystem-based adaptation and environmentally friendly biofertilizer input. We will map out both supply chains of raw material and demand markets for biofertilizer. This mapping will be continuous process.
- Engaging in commercial production of the bio fertilizer at EBApreneur solutions center (To be established)
- Experimentation of the bio fertilizer to collect data on the efficiency of the bio fertilizer in comparison of other fertilizers.
- Testing the market and getting feedback of farmers about the fertilizer.
- expand on the systems approach in driving uptake of the biofertilizer. Where those already using other climate action value addition solution – solar dryers to preserve their produce, will be encouraged to take-up biofertilizer as affordable way to increase yields. Those in cookery enterprises using fuel briquettes will be guided to source from farms that are taking up biofertilizer to enhance the health of their cooking through avoiding both indoor pollution and chemicalized produce.