
The Role of Soil Amendments in Soil and Water Conservation

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ABSTRACT

Soil amendment is referred to as all inorganic and organic substances mixed into the soil for achieving a better soil constitution regarding plant productivity. The aim of this research work is to review the commonly used soil amendment in Nigeria, their effectiveness and the problems that is associated with the implementation of this practice. The common soil amendment in Nigeria includes; poultry litters, cow dung's, compost manure and goat yard manure. Care has to be taken in choosing the appropriate soil amendment depending on the initial soil conditions.

Keywords: *Soil Amendment, soil conditioners, Bio-fertilizers, soil conservation, and water management.*

INTRODUCTION

The pressure of the survival of man and the provision of a better environment for roots and plants growth requires increased degree of strength on the soil and water. A better soil texture and root growth avoids soil degradation during heavy rainfall which gives rise to using the resources judiciously without wastage. (Ogbe, 2008). The problem of drought stress and nutrient depletion is accentuated by high losses of water runoff and severe loss of soil erosion even on gentle slope of <7%. Agriculture which is a major sector of the economy in Nigeria. The sector is transferred by commercialization at the small, medium, and large scale enterprise. Major crops include cassava, yam, maize, rice, cowpea, okra, banana, cocoa, oil palm, cotton, groundnut, plantain, beans, sorghum, pepper, melon and rubber. In the year 1991, about 82 million hectares out of

Nigeria total land area of about 92million hectares were found to be arable. Most soil in Nigeria, like other parts of the sub Sahara Africa in plant nutrient compared to other part of the world (Ishaku, 2008). Lack of volcanic rejuvenation has led to various cycles of weathering (breaking down of rocks into soil), erosion (loss of soil by forces of wind and water) and leaching (washing down of nutrients by water, thereby leaving the soil to suffer from plant nutrients. The ease with which plants nutrients penetrates the plant root zone making it available for plant growth and development is often corrected by applying the right method of soil amendment which may include organic amendments which are derived from plants or plant products that naturally occurs e.g. saw dust, rice hulls, or waste disposal plants (compost processed sewage sludge, animal dung (cow, goat e.t.c.). To loosen the soil and create large pores

so as to increased drainage, aeration, usable water holding capacity and changes the PH of the soil. (Ishaku, 2008). Humus have been known by farmers to be beneficial to plant growth for longer than recorded history which influences soil fertility though its effect on the water holding capacity of the soil, while inorganic substances are tire chunks, sand. They are bought at an expensive price than organic amendments.

A soil amendment includes all inorganic or organic substances mixed into the soil in order to improve the physical and chemical properties. This does not include mulching which includes substances lying on top of the soil (Davis, 2005). A very common amendment is the addition of organic matter, small as compost due to its low production costs. The categories of soil amendment are broad and may include organic amendments to change the texture of soil, fertilizers to boost the nutrient structure, cover crops to add aeration and drainage and when that will change the soil PH. (Stephens *et al*, 2009).

- ❖ Prevents water logging of the soil.
- ❖ Balance air and water in the soil (Increases Infiltration)
- ❖ Increases plant available water
- ❖ Increases the water retention capacity of the soil.
- ❖ It provides nutrients for plant growth
- ❖ It makes wet soil easier to till.
- ❖ It improves the stability of soil organic matter

- ❖ Improves drainage as a result helps earthworms to grow well. Amendment differs from mulching in the sense that mulching is placed on the soil surface while Amendment is added into the soil to improve it. (Organic or Inorganic material).

Factors to Consider when choosing an Amendment

There are four factors to consider in selecting soil amendment.

- ❖ Soil texture
- ❖ Soil salinity and plant sensitivity to salts
- ❖ How long the amendment will last in the soil
- ❖ Salt content and PH (the degree of acidity and alkalinity of the soil affects the availability of nutrients both in the soil and also in the nutrients.(O.A.Iwena,2015) Using laboratory test to detect it.
- ❖ Bearing in mind that the amendment chosen depends on the goal of the researcher.

Soil and Water Conservation

The challenge of the removal of washing away of the uppermost layer of the soil by water and wind has become a thing of the past if proper amendment practice is appropriated. (Nigerian Ministry of Agriculture and Natural Resources, 2009). Taking a look at the country today we observe that the pressure on the demand of arable land has drastically increased which has also led to the increase in the demand for more food by the rise in the percentage of the people living in the country.

Land Degradation

This has been a global issue during the 20th and 21st century as it affects the environment, agronomic productivity, quality of life and food security. (Ishaku, 2008). The soil degradation processes which ranges from the loss of the upper most layer of the soil surface which could be as a result of erosion arising from excessive rainfall and wind, nutrient depletion, such as the compaction of soil and biological deterioration of natural resources which include the reduction of soil biodiversity. (Lal, 2001).

Types of Soil Amendments used in Nigeria

The types of soil amendment used in Nigeria are organic and Inorganic soil conditioners. This is mostly practiced in the Northern part of the country where they grow crops continuously during the rainy season and implement irrigation practice during the dry season. Organic Amendment is derived from something that is alive while the inorganic is derived from man-made.

Organic include (Compost manure, saw dust, and wood ash.

Inorganic include (Perlite, tire chunks and sand. Organic matter when applied properly improves water infiltration, soil aeration, and both water and nutrients holding capacity. Many organic amendments are gotten from plants nutrients and act as organic fertilizer to the soil. (Ishaku, 2008).

Brief Description and NPK Rating of some Amendments used in Nigeria

- **Cow dung's:** This is the most balanced of all manures for organic amendment because of the nature of cow's stomach. This has an NPK Rating of 0.8/0.5/0.5.
- **Chicken:** It is quite glaring that all birds have relatively high metabolisms and body temperature. The manure of poultry birds such as turkeys is a mixture of faeces and urine and is extremely high in Nitrogen which has an NPK rating of 1/1.5/0.5.
- **Pig:** Organically farmed pig manure is very good amendment with an NPK average of 0.6/0.4/0.3.
- **Sheep:** The sheep like other animals such as cow digest their food very well. Their potassium rich fertilizer has an NPK Rating of 0.4/0.3/0.8.
- **Rabbit:** The pellets of rabbits are high in Nitrogen and Phosphorus. It is ideal to compost rabbit pellets before use (NPK).Rating 2/1.4/0.6.
- **Green manure:** These are grasses that are cut down to form humus. It helps to add body to sandy soil.
- **Compost manure:** These are decomposed organic matter. It is not regulated so there is no standard about the state of decomposition.
- **Others:** Wood ash agricultural waste saw dust e.t.c.

Process of Soil Amendment

The various steps involved in soil amendment are as follows;

- i. Initial soil disturbance

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- ii. Breaking up of the sub soil
- iii. Rock removal
- iv. Distribution of soil amendment agent
- v. Soil integration, grading and mixing of the soil with the amendment.

Factors to Consider when Choosing an Amendment

There are four factors to consider in selecting a soil amendment. Namely;

- i. How long the amendment will last in the soil
- ii. Soil texture
- iii. Soil salinity and plant sensitivities to salt
- iv. Salt content and PH of the amendment laboratory test will be used to determine the salt content, PH, and organic and inorganic amendment.

Cost of Amendment

Organic soil amendments are generally cheaper having high self help compatibility because farmers can produce them on site compared to inorganic fertilizer. These include the cost of buying transportation and application of the amending agents, monitoring the effectiveness of pollutant removal and replacement of amended soil. Since most inorganic amendment are mined from natural deposits and further processed to yield the fine product. Heavy machinery and technical knowhow is necessary to produce such amendments. The Facts Caused further cost in production.

Purpose and Uses of Soil Conditioners

▪ **Soil texture and structure:**

Soil texture is of great importance in agriculture because it determines the type of soil that is formed in the area being the most consistent physical property of the soil, and determines the consistency of the soil.

Soil compaction impedes the root growth decreasing the ability of plants to take up materials and water. The texture of a particular soil determines the extent to which nutrients is made available to plants.

▪ **Soil nutrients:** Long before now man has been adding things to poor soil to improve their ability to supplement plant growth. Example of soil materials is compost, mineral matter (inorganic) which represent small rock fragments of the soil. It is from the bulk amount of 45% of total volume of the soil. It is the main source of the plant material such as nitrogen, Calcium, Magnesium and iron (O.A.IWENA, 2005).

▪ **Cation Exchange:** Soil amendment can greatly improve the cation exchange of the soil. Soil acts as store houses for plant nutrients. Clay minerals soil, and sandy soil have low cation exchange, hence it reduces the availability of nutrients. Loamy soil has high caption exchange and easy availability of nutrients.

▪ **Water Retention:** Soil amendment is used to regulate the water retention of the soil which tends to improve it in dry coarse soil

which does not have the capacity to retain water properly.

The addition or mixture of organic material tends to improve the water retention abilities of sandy soil and also used to adjust the PH of the soil to suit the need of a specific plant.

Challenges Associated with the Use of Soil Amendment

- I. There arise the potentials for the release of phosphorus from amended soil if the PH of the storm water becomes too acidic. (E.g. PH 5).
- II. Soil amendment has an effective lifespan, if nutrients are not recycled by plants and micro organisms.
- III. Determining the phosphorus retention capacity of the amendment agents as these can vary considerably.
- IV. Care is very essential to prevent the introduction of contaminants in the amendment agents (e.g heavy metals, Radioactive materials, pathogens) which are harmful to human agents (materials used and where should be noted).

Composition of the Soil

- a) Inorganic matter
- b) Organic matter
- c) Soil water
- d) Soil air
- e) Living organism

CONCLUSION

The practice of soil amendment is a good practice for the conservation of

soil and water for sustained agricultural production.

The soil conservation method should be site specific depending on the local factors such as topography, soil texture, water regime and farming system. On sandy clay, soil amendment improves and increases the soil aggregation, increase porosity, permeability and improve aeration, drainage and rooting depth. Manure and manure based compost are readily available which are often high in salt as a result limiting the application rate.

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