Purpose of Fact Sheet:

The Fact Sheet is to:

- create awareness and educate project beneficiaries (farmers, CBAs, women and youth) on bio-fertilizer (biochar) technology;
- facilitate adoption of bio-fertilizer (biochar) technology;
- highlight the procedures for biochar production, applications, precaution, etc.; and
- introduce biochar production as agribusiness.

Background:

One of the critical challenges limiting agricultural productivity in Niger State, is the issue of soil degradation, arising from iron toxicity. Numerous researchers, including (Onyekwere 2010; Gana 2012; Lawal *et al*. 2014) affirmed the existence of iron toxicity and soil acidity in Niger State. Iron toxicity is a plant nutritional problem associated with excess water-soluble +ion. It is prevalent in numerous soil types, especially acidic soils (Gana, 2012). The characterization of iron toxicity included low pH, dryness of the soil, high iron oxide content, poor drainage, low soil organic matter, browning and drying of leaves among others, culminating in poor growth, tillering and colossal yield reduction.

Arising from this backdrop, effective, sustainable and economic approaches to solving this problem becomes imperative. Some of the approaches previously used in redressing this problem, included; liming, application of chemical fertilizers and the use of organic matter. However, these approaches have their limitations, including accessibility issues, partial control and repeated treatments, with obvious cost implications, prompt decomposition of materials, competition from other users, immobility and ultimately, unavailability of required

nutrients in the soil, chemical pollution, increased global warming, among others.

Biofertilizers: These are materials that consist of micro-organisms and the substrates in which they live. They support nutrient uptake when in association with their hosts. They include nitrogen fixing organisms, compost, mycorrhiza, inoculants and biochar, which is an amended form of biofertilizer.

Biofertilizer Amendment (Biochar):

The amendment of bio-fertilizer (biochar) has been proven to address the Fe-toxicity issue, while also solving the challenges associated with the other approaches. **Biochar** is a charcoal or black carbon made from incomplete combustion of organic matter at temperatures above 660^{O}F (350^{o}C), with very limited oxygen. It is an enabler, preserver of soil and supplier of soil nutrients. Plant or animal organic matter can be used as the raw materials (feedstock), but plant materials, such as rice husks are preferred (Cox, 2019). Under the project, biochar is being produced through adaptable biofertilizer kilns. For the biochar to constitute a biofertilizer, inoculation of iron tolerant bacteria is paramount (Chandwani *et al.*, 2022).

Benefits of Biochar:

Recently, the choice of biochar technology has been deployed as soil amendment. Aside been proven to increase yields by approximately 20% (Biederman & Harpole, 2013), its other benefits include the following:

- supporting growth of microbes which aids soil health and improves plant growth;
- serving as reservoir of water and nutrients;
- boosting plants ability to take up nutrients;
- decreasing green-house gases;
- minimizing the toxic effect of heavy metals;
- enhancing soil physical, chemical, biological processes and amendments;

- increasing soil biological activities for nutrient sustainability; and
- increasing soil pH and organic matter, etc

Biochar Production:

The production of biochar entails the following:

- site selection;
- Sourcing of rice husks from miller;
- feeding the biochar degrader and blending machine with feed stock;
- heating feed stock through biochar kiln with very little air at temperature above 350^{o}C to reduce combustion;
- grinding and passing biochar through sieve;
- Measurement of moisture content and pH
- diluting biochar with de-ionized water (though, not in all cases) and brief heating to allow dissolution of soluble; and
- spreading on soil surface using trowel or shovel.

Technology Dissemination Strategies:

Training, demonstration, technology transfer through Extension Agents, Community Based Agents, participatory production, use of remote sensing and soil sensor to monitor implementation and compliance.

Recommendations:

- Avoid non-degradable materials
- Soak biochar overnight and drain before use (depending on the content of feedstock)
- Use with compost mix, other biofertilizers and inorganic fertilizers for optimum yield
- Keep on ground where it is not easily airborne
- Avoid adding to top mulches
- Keep in a dry place
- Can be used for all crop types
- Recommended rate is an average of 5mt/ha

Safety Precautions:

Handle production outdoor and store in sealed bags; wear dust mask before handling; avoid usage on dry soil to limit dust exposure; avoid adding to top mulches.

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Niger State Consortium Project

Improving Farmers' Resilience and Upscaling Productivity, Incomes, and Livelihood in Rice, Maize, Soybean, Cowpea, and Vegetable Value Chains in Niger State

Addressing Iron (Fe) Toxicity through Organic Fertilizer Amendments in Niger State

Biochar Technology Fact Sheet