Purpose of Fact Sheet:

The purpose of the Fact Sheet is to**:**

- sensitize project beneficiaries on the use of ISFM techniques and approaches to addressing soil infertility, including iron toxicity;
- cause adoption of ISFM practices;
- guide farmers on the application of ISFM within recommended farming system;
- create awareness for integration of complementary practices within the farming system; and
- provide justification for the use of ISFM.

Background:

Soil degradation due to iron toxicity has been a key challenge in Niger State, contributing to low crop productivity, food insecurity and exacerbation of greenhouse gases (Niger Consortium, 2021). The trend, continued to limit soil productivity and yields of major crops, relative to best practices. For instance, the average yield of rice, a key staple in the state, stood at 2.5 mt/ha; even though, 60% productivity growth to 4.0 mt/ha was observed across AGRA's project locations between 2017 and 2020 in the State (Niger Consortium, 2021), this falls short of the 7.0 mt/ha obtained under best practices (International Institute of Tropical Agriculture (IITA), 2017).

Meanwhile, the reliance on chemical fertilizers as the way out to redressing degradation and achieving food security in tandem with national, regional and global initiatives has also not yielded the desired results. Rather, the prolonged use of chemical fertilizers became environmentally destructive, unsustainable, with colossal effects on crop yields in the state. Aside these, scarcity and low purchasing power by the poor resource farmers, limited fertilizer consumption per hectare to between 11kg/ha and 20 kg/ha across the country (AGRA, 2020), compared to 50kg/ha recommended by the 2006 Abuja Fertilizer Declaration.

This necessitated the focus on sustainable alternative, such as biofertilizers. Though, the organic option has enormous necessitated the capabilities to improve soil physical, chemical and biological qualities, as well as addressing environmental concerns; however, the low nutrient reserve associated with some of the available options and the considerable quantities required are of concern. These developments necessitated the emphasis on ISFM, which integrates both the inorganic and organic options.

Concept of ISFM

ISFM refers to a set of soil fertility management practices that necessarily includes the use of chemical fertilizers, organic inputs and improved germ plasm, combined with the knowledge of local adaptation of practices to optimize agronomic and economic use efficiencies, enhance crop productivity, improve food security, among other development outcomes (Fairhurst, 2012; Nigeria Institute of Soil Science, 2019)

The current approaches to the problem of poor soil fertility are premised on the following principles (Nigeria Institute of Soil Science, 2019):

Principles of ISFM:

- neither the use of mineral fertilizers nor sole on organic manure management are sufficient for sustainable agricultural production;
- well adapted high breed, disease-and pest-resistant germplasm is necessary to make efficient use of available nutrients;
- good agronomic practices in terms of planting densities and weeding are essential to ensure efficient use of scarce nutrient resources;
- target nutrient resources with crop rotation cycles, beyond recommendations for single crops; and

- integrate agroforestry and livestock within farming system, where feasible.

ISFM technologies proposed under project:

- **Biofertilizers:**

  Biofertilizers are natural products, synthesized by living organisms, utilizing plant and animal residues. Rice husks are the major feedstock under the project, given the comparative advantage of State in rice production and preponderance of rice processing mills. The biofertilizer interventions proposed under the project include biochar, compost, mycorrhiza and inoculant.

  - **Biochar** - An organic material used as a soil amendment to improve soil nutrients for crop production. It is produced through pyrolysis from the thermo-conversion of biomass under little or no oxygen supply for use in soil as an amendment.
  - **Compost**- Refers to the decomposition or breakdown of organic waste materials by a mixed population of micro-organisms (microbes) in a warm, moist, aerated environment.
  - **Mycorrhiza**- These are ubiquitous soil micro-organisms with great potential to enhance plant growth and soil aggregation.
  - **Inoculum** - This refers to extracts from micro-organisms used in the soil or body of the planting material or crop. It is preferred as slurry, concentrate, granules and powdery forms.

- **Mineral Fertilizers**

  Fertilizers are materials that contain at least one of the plant nutrients in chemicals form. It is soluble in the soil on application and available for plant root. The common ones are NPK, urea, potassium chloride (KCL) and diammonium phosphate (DAP).

- **Agroforestry and Livestock.**

  Integration of Agroforestry and livestock production into farmers' farming systems, where feasible.

Benefits and Justification for ISFM:

- Improves both soil quality and the efficiency of fertilizers and other agro-inputs.
- Enhances germplasm, agroforestry and use of crop rotation and/or intercropping with legume. A practice which enhances soil health, hence improves soil fertility through synergy mechanism.
- ISFM technologies have been established to more than double agricultural productivity and increase farm-level incomes by 20% - 50% (NISS, 2019).

Recommendations/Application rates:

Biofertilizers

This can be applied as follows depending on manufacturers' recommendations:

- **Seed Treatment:** 200 g of rhizobium inoculant is suspended in 300-400 ml of water and mixed gently with 10 kg of seeds using an adhesive like gum acacia solution, etc.
- **Root Dip:** Biofertilizers are mixed in water and the roots of seedlings are dipped for 8-10 hours and transplanted. Mainly used for transplanted crops.
- **Soil Treatment**: 4 kg each of the recommended biofertilizers is mixed in 200 kg of compost and kept overnight. This mixture is incorporated in the soil at the time of sowing or planting.
- The organic and inorganic fertilizers can be applied as half the recommended rate for a particular crop because of the combination.

Chemical Fertilizers - Farm specific applications recommended in line with international best practice.

Technology Dissemination Strategies:

Awareness creation, training, knowledge product development, demonstration, etc.

Safety Precautions:

Key safety precautions include the following:

- Air drying the coated seeds to properly coat before planting;
- Encouraging the use of hand gloves and nose mask;
- Proper handling of material to avoid contamination, etc

References:

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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

Integrated Soil Fertility Management (ISFM) Fact Sheet