

Integrated Nutrient Management

Brief on the INM component of the Sustainable Land Management Project · Sustainable Land Management Uganda

Introduction

The integrated nutrient management (INM) approach involves use of soil and water conservation practices, supplemented by application of organic and inorganic fertilizers to increase soil productivity. These practices have been used for soil management in different agro-ecological zones of Uganda (Kaizzi et al., 2012; Ebanyat et al., 2009; Majaliwa et al., 2003). Some of the challenges addressed by INM include soil moisture stress, nutrient depletion and poor water holding capacity of sandy soils, among others.

1. Calcium bentonite combined with organic and inorganic fertilizers

Bentonite is a 2:1 clay mineral which holds water in soil and avails it for plant uptake. Due to its moisture retention properties, bentonite could be used to improve sandy soils, hence a possible mitigation measure for moisture stress. Bentonite is mined in Hoima (Uganda) by Knights Mining Company and exported. Studies were conducted in Nakasongola, Ngora and Katakwi districts to develop alternative soil water management options for sandy soils in drought stricken areas, through use of Ca-bentonite.

Key findings: Ca-bentonite application significantly ($P < 0.05$) increased soil moisture content, maize dry matter, and consequently, grain yield by 40% (Semalulu et al., 2015). Ca-bentonite (2.5 t/ha) increased soil moisture and grain yields of maize, millet, sorghum, green-grams and groundnuts above the control by 11, 20, 14, 17 and 5% respectively (Semalulu et al., 2017). Yields were even higher (65 to 108% above the control) where bentonite was combined with farmyard manure (FYM), diammonium phosphate (DAP) and/or single superphosphate (SSP).

Ca-bentonite has potential as a soil amendment for moisture conservation, neutralising acidity, and improving N, P, Ca and Mg content in sandy soils — a possible amelioration for sandy soils of low fertility in drought-stressed environments. It was more profitable when used on high-value crops like groundnuts, compared to maize, millet, sorghum and green grams. Options to make bentonite use more profitable include use on higher value crops, blending with other materials, use as a sand amendment in greenhouses, and policy support to lower production costs.

2. Supplemental irrigation with organic/inorganic fertilizer

Trials on the interactive effects of organic and inorganic fertilizers under supplemental irrigation were conducted in Nakasongola District in the central Cattle Corridor of Uganda. Irrigation systems tested were drip, furrow and sprinkler, against a no-irrigation control. Fertilizer treatments included farmyard manure (2.5 and 5 t/ha), alone or combined with diammonium phosphate (62.5 and 125 kg/ha) and urea (60 and 120 kg/ha).

Key findings: supplemental irrigation significantly increased rice (NERICA 4) grain yields (control 1,806 kg/ha; drip 2,336 kg/ha; furrow 2,810 kg/ha; sprinkler 5,012 kg/ha). Maize (LONGE 10H) yields were also significantly increased (control 293 kg/ha; drip 793 kg/ha; furrow 1,372 kg/ha; sprinkler 1,056 kg/ha). Of the three systems, drip performed poorest for both crops. Under moisture-stressed conditions, fertilizer application alone — organic or inorganic — did not significantly increase yields without irrigation.

These findings have been disseminated through field demonstrations in Nakasongola, Ngora and Katakwi districts, NARO Annual Review & Planning meetings (2014–2017), NARO biennial scientific conferences, posters at the National Agricultural & Trade Show (Jinja, 2017), and peer-reviewed publications.

Recommendations

Measures to make locally available Ca-bentonite economically feasible for small-scale farmers should be supported through blending with other materials and policy support to reduce production cost.

Use of supplementary irrigation through sprinkler and furrow systems should be promoted over drip in these conditions.

There is need for increased awareness creation on the benefits of these technology packages.

In addition to Ca-bentonite, use of alternative resources with similar characteristics, such as vermiculite, should be promoted.