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Combine effect of bio-fertilizer and poultry manure on growth, nutrients uptake and microbial population associated with sesame (*Sesamumindicum* L) inNorth-eastern Nigeria

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Abstract: *The combine effect of bio-fertilizer (Azospirillum and arbuscularmycorrhiza fungi, AMF; Glomusmossea)and poultry manure (PM) on nutrients uptake, plant growth and soil microbial population associated with sesame under field condition was studied. The experiment comprised of four treatments; T1 (Azospirillum + AMF), T2 (Azospirillum + AMF + 5 ton ha^{-1} poultry manure), T3 (10 ton ha^{-1} poultry manure), and T0 (Control) laid out in randomized complete block design with three replications. Plant growth parameters viz., plant height, numbers of leaves/plant, numbers of branches/plant, leaf area, shoots and root dry biomass increased significantly due to the application of bio-fertilizer and poultry manure singly or in combination over control. Combined application of bio-fertilizer and poultry manure @ 5 ton ha^{-1} (bio-organic) significantly produced the plants with desirable growth parameters, nutrients content and uptakes for N, P, and K. Root colonization by AM fungi was recorded in inoculated and un-inoculated plants. Colonization % ranges from 6% in control to 62.8% in Bio-organic. There was no significant difference in % root colonization of inoculated plants. Populations of Azospirillum and AM spores have increased in all treatments over the initial population prior to experiment in all treatments. Bio-organic recorded the highest Azospirillum population (28.56 × 10^{-6} CFU g^{-1} soil) and 69.3 AM spores g^{-1} soil and values were significantly higher to all the treatments. The overall findings of this research indicated that Bio-organic(bio-fertilizer and poultry manure @ 5 ton ha^{-1}) produced plants with highest growth parameters, nutrients uptake, increased soil Azospirillum population, AM spore density and mycorrhization compared to exclusive application of bio-fertilizer or poultry manure @ 10 ton ha^{-1}.Combination of bio-fertilizer with organic amendments could be recommended for successful production of sesame.*

Key words: *Bio-fertilizer, Poultry manure, Bio-organic, Plant growth, Nutrients uptake, Microbial population*

I. Introduction

Sesame (*Sesamumindicum* L.)orbeniseedis a high value cash crop commonly cultivated by small holder farmers in Nigeria (Uwala, 1998; Alegbejo, 2003) for oil seed. The seed is nutritious: it contains 50-52% oil, 19-25% protein and 16-18% carbohydrates (Uzoh, 1998; Weiss, 2000). Sesame is adapted to many soil types, drought- tolerant andgrows on poor fertile soil. Virtually, poor-resource holder farmers in Nigeria rarely apply fertilizer, but, best yields are obtained inproperly fertilized farms (PapariMoghaddamfard and Bahrani, 2005; Saeidi, 2008; Anon, 2006; Malik et al., 2003; Rao et al., 1994). Poor soil nutrients concentration especially, lowN, P and soil organic matter, coupled with unscientific method of cultivationare major constraints to its production in Nigeria. Yields are as low as 300 kg ha^{-1} compared to 1,960 kg ha^{-1} in Venezuela, 1,083 kg ha^{-1} in Saudi Arabia (Abubakar et al., 1998), 1323kg ha^{-1} in Egypt and 825kg ha^{-1} in Ethiopia. Chemical fertilizers have been used for decades to increase crop yield. However, current trends in agriculture are focused on search for alternative to chemical fertilizer due to, huge cost of procurement, contamination of environment, and couple with improper application leading to the degradation of soil quality (Tilman*et al*., 2002). Furthermore, the world demands for the production of quality food and in a most sustainable way maintaining soil biodiversity. Moreover, food produced organically fetch premium price in global market.

Bio-fertilizer (microbial inoculants) and organic amendments are cheap nutrient source that could serve as alternative to chemical fertilizers and improve crop production in low-input agriculture.Application of organic amendments, increases soil organic carbon and stimulate microbial activity which provides N and P to soil. Soil microorganisms on the other hand play a vital role in their ability to provide and recycle nutrient for plant growth (Weil and Magdoff, 2004). Their population and activities may not only reflect the quality of soil, but also reflect soil environmental conditions (Leaungvutiviroj et al., 2010). They are involved in interactions with plant roots, either symbiotically or as free-living, improving plant nutrients uptake, bolster crop production and improve soil quality (Wu et al., 2005; Okon and Itzisohn, 1995; Shah et al., 1992). Sesame production using organic amendments (Haruna and Abimiku, 2012;Ogbonna and Umar-Shaba, 2012) and chemical fertilizers