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Production Potential and Economics of Groundnut-Onion Cropping System and Associated Soil Fertility Changes under Organic Nutrient Management Packages in Semi-arid Rajasthan

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Abstract

A field experiment was initiated in *kharif* 2003 at Rajasthan Agricultural Research Institute, Durgapura, Jaipur to study the production potential and economics of groundnut-onion cropping system under organic nutrient management packages and their impact on soil fertility. The soil of the experiment site was loamy sand with pH 8.1, EC 0.25 dS m^{-1} and water holding capacity of 16%. The initial values of nutrients were 2.1 g kg^{-1} organic carbon, 34 kg available P_2O_2 ha^{-1}, 191 kg available K_2O ha^{-1}, 7.8 mg kg^{-1} available S and 0.5 mg kg^{-1} available Zn. The crop sequence was groundnut in *kharif* and onion in *rabi* season. The seven treatments consisted of various combinations of nutrient sources. Results of ten-years cropping cycle indicated that highest pod yield of groundnut (1.27 t ha^{-1}) as well as bulb yield of onion (17.56 t ha^{-1}) was recorded under treatment T_7 (100% recommended NPK + S through gypsum + Zn through zinc sulphate). In a comparison between the treatments receiving organics (T_3, T_4, T_5, and T_6), treatment T_3 (recommended dose of nitrogen equally through three sources viz. FYM, vermicompost and neem cake and inter-crop of mungbean in groundnut) recorded highest pearl millet equivalent yield (18.76 t ha^{-1}) which was 9.7% higher than that under over treatment T_1 (50% recommended NPK + 50% N as FYM+ Zn through zinc sulphate) but, it was 8% lower than the treatment T_7. The highest organic carbon content (2.81 g kg^{-1}) was observed in the plots receiving treatment T_2 where the treatment was identical to treatment T_3 except for intercrop in the *kharif* season. Higher available P_2O_5 content was observed in treatment T_6 (T_2 + biofertiliser for N & P) with mean value of 37.2 kg ha^{-1} which was at par with treatment T_5 (50% recommended N through FYM + inoculation with *Rhizobium* + recommended P as HGPR+ PSB culture) whereas a higher available K content was observed in the RDF treatment of T_7.

Key words: Groundnut-onion cropping sequence, pearl millet equivalent yield, organic nutrient, manure

Introduction

Groundnut (A*rachis hypogaea*) - onion (*Allium cepa*) is an important cropping system in arid and semi-arid regions of India gradually replacing the otherwise predominant pearl millet-wheat system because of the second generation problems such as over-mining of soil nutrients, diminishing productivity, etc. faced by the latter (Gangwar et al., 2012). Groundnut is an important legume *kharif* crop in Rajasthan mainly grown for oilseed, food and animal feed. The current area (4 lakh ha) under groundnut has almost doubled in the state during last four decades. The crop has occupied new area in desert districts as an irrigated crop (DOA, 2013). It is an exhaustive crop and removes large amounts of macro- and micro- nutrients from the soil (Latha and Sharanappa, 2014). Onion is a major vegetable as well as spice crop grown for commercial purpose. Dehydrated powder and flakes prepared out of onion provide rich agro-industrial base for onion crop. Area under onion in Rajasthan has expanded very fast but the average bulb productivity (9 t ha^{-1}) is still abysmally low (DOA 2013) due largely to poor management practices. It is again a high-nutrient removing crop (Anonymous, 2014). Organically produced onion possesses better physical and bio-chemical quality (Prabhakar *et.al.* 2012) and is thus a potential source of foreign exchange as a large quantity of onion is being exported (NHB, 2014). Onion being a shallow rooted crop may not utilize all the nutrients applied to soil. The unutilized nutrients may be leached down along with irrigation water or rain water. These unutilized nutrients present in subsoil can be effectively absorbed by a deep-rooted crop like groundnut in the succeeding season. Thus groundnut-onion system has a unique potential for higher use efficiency of nutrients, soil fertility as well as monetary returns (Anonymous, 2014).

Organic farming is a holistic production technique that relies on ecosystem management rather than external agricultural inputs. The system aims at eliminating synthetic inputs and encourages use of on-farm generated resources and by-products. The semi-arid eastern plain zone of Rajasthan has an advantage of going in for organic farming as more than 60% of the holdings are small and marginal, having low capacity to purchase costly external inputs like fertilisers and plant protection chemicals. Soils are characterized by poor soil organic carbon (SOC), light texture, low water and nutrient holding capacity. Due to poor soil physical condition, particularly for coarse

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