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Title

Long Term Effects of Nutrient Management and Cropping Systems on Soil Organic
Carbon Stock of Groundnut Based Cropping Systems

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Groundnut (*Arachis hypogea* L.) is an important edible oilseed crop in India. grown on 8 m hectare land, produced 7.7 m tonne pods with an average productivity of 950 kg/ha. Rain depended and monoculture is the common feature of groundnut cultivation in West Coastal Gujarat region of India. But, having wheat crop wherever irrigation facilities available in post rainy season. Cropping systems depend upon soil characteristics, ecological suitability of crops, commodity prices, availability of equipment and labor, can have a dramatic impact on crop yield, development of pest complexes, and economic return of the groundnut growers. Nutrient management in cropping systems is an important aspect for sustainable production system in long run. Different crops in the system have different nutrient requirement and, if investigated systematically, may help to regulate the nutrient demands of the succeeding crops in terms of saving in fertilizer and changes in soil fertility. According to Bragato and Primavera (1998), soil organic carbon is one of the indices of sustainability of a production system under a set of management practices, because organic matter enhances soil quality by improving soil structure, nutrient storage, and biological activity. A thorough understanding of these factors and their interactions is critical in maximizing profitability of any cropping system. Thus, the present study was initiated in 1998 with five popular groundnut based cropping system in the region *viz.*, sole groundnut, two intercropping systems (groundnut+pearl millet and groundnut+pigeon pea) and two sequential cropping systems (groundnut–wheat and groundnut–wheat–green gram) under different combinations of organic and inorganic fertilizer regimes. The field experiments are being conducted at Directorate of Groundnut Research, Junagadh, Gujarat to assess the (i) long term effects of nutrient management and, (ii) groundnut based cropping systems on soil organic carbon content and productivity of groundnut based cropping systems.

Groundnut was established at 30 cm row to row and 10 cm plant to plant spacing on the onset of monsoon. In groundnut+pearl millet intercropping systems, groundnut and pearl millet planted in alternate rows at 30 cm spacing. While, in groundnut+pigeon pea intercropping systems, three rows of groundnut alternated with one row of pigeon pea. In groundnut-wheat rotation, wheat was grown at 30 cm row to row and 7.5 cm plant to plant spacing in the post rainy *rabi* season and in groundnut-wheat-green gram rotation, green gram was grown as green manuring crop after wheat in summer season. Groundnut was sown after one deep ploughing with mould board plough, followed by two shallow ploughing with cultivator and than

planking. Cultivation practices for all crops are as per recommended practices, except nutrient management. Nutrients were applied as per treatment; 100% recommend dose of fertilizers (RDF) and 50% RDF+5 t farm yard manure (FYM) per hectare to groundnut; 100% RDF, 50% RDF and 50% RDF+5 t (FYM) per hectare to wheat; 100% RDF and 50% RDF to each of pigeon pea and pearl millet crop. Green gram was raised as green manure crop without any fertilizers. The economic yield was calculated on net plot area basis and than converted to kg/hectare. The organic carbon content before sowing of groundnut and after harvest of the crops in the cropping system were analysed by the colorimetric method as suggested by Datta *et al.*, 1962. The ten-year results revealed that soil organic carbon content increased more in the groundnut-legume cropping systems (0.93-1.05%) compared to groundnut-cereal rotation (0.65-0.70%). The groundnut+pigeon pea intercropping system increased maximum soil organic carbon content from 0.53% in 1998 to 0.97% in 2007. The groundnut+pigeon pea system have accumulated highest organic carbon and added 43% more over the initial level, as compared to groundnut monoculture (34%), groundnut-wheat (5%), groundnut-wheat-green gram (7%) and groundnut+pearl millet (32%). The nutrient management of various cropping systems also affected the soil organic carbon significantly. In groundnut-groundnut, groundnut+pigeon pea and groundnut+pearl millet cropping systems the highest organic carbon content were found with 'FYM (5 t/ha)+50% RDF' to groundnut and 50% RDF to the component crops as compared to 100% RDF to groundnut and 100% to the component crops. Where as, the groundnut-wheat and groundnut-wheat-green gram sequential cropping systems showed highest soil organic carbon with 'FYM (5 t/ha)+50% RDF' to groundnut and 'FYM (5 t/ha)+50% RDF' to the subsequent wheat crop. The interaction effects showed that the groundnut-wheat-green gram systems with 'FYM (5 t/ha)+50% RDF' to groundnut and 'FYM (5 t/ha)+50% RDF' to wheat crop recorded the highest organic carbon accumulation (0.87%) in the soil over the years. The results impressed that under intensive cropping system with 200-300% cropping intensity, groundnut-wheat-green gram system showed maximum groundnut equivalent yield (GEY) and total system productivity of 3865 and 6000 kg/ha followed by 3401 and 5100 kg/ha by groundnut-wheat system, respectively over the years. Application of FYM in *kharif* groundnut and incorporation of green gram crop residue (700-1000 kg/ha) helped to improve physical and biological properties of the soil that was evident from the productivity analysis of the systems.

Reference:

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