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Is integrated crop-livestock system an answer to restoring soil quality and health?

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Declining soil fertility and quality as a result of poor farming practices and changing climate is a big threat to sustainability of crop production. To meet the growing demand of increasing human population and enhance soil fertility, quality and health, integrated crop-livestock system (ICLS) has been proposed as one of the best farm management practices. The International Atomic Energy Agency (IAEA), in partnership with FAO through the Joint FAO/IAEA Division, assists the Member States of IAEA in developing best farm practices to store and retain essential plant nutrients as well as carbon in soil to make it resilient against climate change, and they do this through the use of nuclear techniques. To assess the impact of ICLS on soil quality, three farms under different land uses in Southern Santa Fe Province, Argentina were selected. The three farms under 3 land uses were, a) natural vegetation, b) ICLS farm which produces Lucerne (Medicago sativa Merrill) and oat (Avena sativa L.) grazed by cattle alternatively with grain summer crops sequence of soybean (Glicine max L.) and corn (Zea mays L.), and c) continuous cropping system (CCS) which produces soybean and corn in a continuous sequence. Replicated soil samples were collected from different soil depths and analyzed for soil organic carbon (SOC) and their isotopic signature (C-13). Significantly higher amount of C was found in ICLS compared to CCS. Carbon-13 signatures varied among the three land uses, and were higher for natural vegetation and ICLS compared to continuous cropping system. For example, C-13 signatures in 0– 5 cm for the natural vegetation, ICLS and CCS were -20.10, -20.04 and -19.76 per mil respectively; while such values in 5– 20 cm soil depth for these treatments were -17.29, -17.60 and -17.88 per mil respectively. Our results showed that C-13 signatures identified the sources of C inputs in soil and ICLS improved soil quality and health by exhibiting significantly higher amount of C in 0– 40 cm soil depth.