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Multifunctional agroecosystems in the semi-arid environment to mitigate the impacts of climate change

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The governments of the world have been concerned about climate change and how they can ensure access to sufficient food, water and energy resources to safeguard human wellbeing. The Brazilian semi-arid, covering approximately 969.589 km^2, has 21 million people and 1.6 million of agricultural establishments of which 95% are classified as family farms. The typical agricultural systems are characterized by high grazing density, slash and burn practices and fruits and legumes irrigated monocultures. Consequently, soil degradation occurs due unsustainable soil management, decreasing soil carbon stock and the biodiversity. The aim of the work was to design sustainable multifunctional agroecosystems adapted to the soil and climatic conditions and that deal with climate change through carbon sequestration. The study was carried out in two long-term experiments with mango trees (*Mangifera indica* L.), implanted in 2008, and melon crop (*Cucumis melo* L.), implanted in 2012, in Ultisol, located in Pernambuco, Brazil, latitude 09 °09'S, longitude 40°22'W and altitude 365,5m. Experimental areas contemplate models of multifunctional agroecosystems that include two phytomass management systems as main plots (tillage and no-tillage) and three types of plant mixture (PM), as subplots, two of which are composed of 14 species of green manure in different proportions of grasses, oilseeds and legumes (PM1- 75% leguminous + 25% grass and oilseeds; PM2 - 25% legumes + 75% grasses and oilseeds) and one with spontaneous species (PM3), between the lines or in succession, in a randomized complete block design, with four replications. The phytomass production and changes in soil carbon stocks were evaluated over time. The green manures, regardless of the soil management system, promoted significantly higher production of phytomass (PM1= 7,87±0,44 Mg ha^{-1} and PM2= 7,63 ± 0,53 Mg ha^{-1}) than spontaneous vegetation (PM3= 4,00 ±0,34 Mg ha^{-1}). The cultivation of plant mixtures with no-tillage were the agroecosystems more efficient in increasing the soil carbon stocks (0,6 Mg ha^{-1} year^{-1}) than agroecosystems with spontaneous vegetation and or soil tillage (0,09 Mg ha^{-1}year^{-1}), in first layer (0-5 cm). Multifunctional agroecosystems designs that contemplate the use of green manures and no tillage are efficient in increasing the carbon stock in irrigated semiarid environments, composing a technological strategy to mitigate the impacts of climate change.

Keywords: Green manure, no tillage, dryland.

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