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# Carbon stocks quantification in agricultural systems employing succession and rotation of crops in Rio Grande do Sul State, Brazil.

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Soil and vegetation constitute respectively the third and the fourth terrestrial reservoirs of Carbon (C) on Earth. C sequestration in these reservoirs includes the capture of the $CO_2$ from the atmosphere by photosynthesis and its storage as organic C. Consequently, changes in land use and agricultural practices affect directly the emissions of the greenhouse gases and the C sequestration. Several studies have already demonstrated that conservation agriculture, and particularly zero tillage (ZT), has a positive effect on soil C sequestration. The Brazilian federal program ABC (Agriculture of Low Carbon Emission) was conceived to promote agricultural production with environmental protection and represents an instrument to achieve voluntary targets to mitigate emissions or NAMAS (National Appropriated Mitigation Actions). With financial resources of about US$ 1.0 billion until 2020 the ABC Program has a target of expand ZT in 8 million hectares of land, with reduction of 16 to 20 million of $CO_2$eq. Our objective was to quantify the C stocks in soil, plants and litter of representative grain crops systems under ZT in Rio Grande do Sul State, Brazil. Two treatments of a long term experimental essay (> 20 years) were evaluated: 1) Crop succession with wheat (Triticum aestivum L.)/soybean (Glycine max (L.) Merril); 2) Crop rotation with wheat/soybean (1st year), vetch (Vicia sativa L.)/soybean (2nd year), and white oat (Avena sativa L.)/sorghum (Sorghum bicolor L.) (3rd year). C quantification in plants and in litter was performed using the direct method of biomass quantification. The soil type evaluated was a Humic Rhodic Hapludox, and C quantification was executed employing the method referred by “C mass by unit area”. Results showed that soybean plants under crop succession presented greater C stock (4.31MgC ha-1) comparing with soybean plants cultivated under crop rotation (3.59 MgC ha-1). For wheat, however, greater C stock was quantified in plants under rotation comparing with that under succession (4.95 and 4.14 MgC ha-1, respectively). No differences between succession X rotation (1st year) and succession X rotation (3rd year) were found for litter. Differences in C stock in litter were found only comparing succession (2.42 MgC ha-1) X rotation (2nd year) (3.44 MgC ha-1). Average values of soil C stocks at depth 0-30cm under succession (67.79 MgC ha-1) and rotation (64.83 MgC ha-1) don’t differ among treatments. These values in comparison with other determined for similar soil-climate conditions for soils under native forest (60.83 MgC ha-1) and under conventional tillage (60.68 MgC ha-1) reveals a beneficial effect of ZT in soil C stock. Finally, the C stocks determined for plants and litter, representing only 4.0% and 6.4% of that determined for soil, confirm the relevance of soil as a terrestrial C reservoir.

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