Development of the Brazilian scientific production on soil organic matter and climate change: a bibliometric review

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Objectives

The objective of this work is to characterize, through a bibliometric review, the development of the Brazilian research on topics related to soil organic matter and climate change. More specifically, the objectives are identifying the main study areas and the relations that they establish; identifying trends in the research field through the last few years; and finding possible gaps that need to be filled.

Materials and Methods

The bibliometric review was conducted based on a selection of documents from Web of Science. On that account, aiming to select the largest quantity of articles that meet the objective of this work, the following search-key was constructed: soil AND ("* carbon" OR "organic matter" OR "greenhouse gas*" OR "nitrous oxide" OR n2o OR methane OR ch4 OR "carbon dioxide" OR co2) AND (bra?il OR amazon* OR pantanal OR "mata atl?ntica" OR caatinga OR cerrado OR pampa). This search selected 7,607 documents that were reduced to 4,873 with the aid of the restriction tools available on the platform. In such manner it was possible to discard documents which are irrelevant to this work. Next, once the data base was constructed, the annual development of publications was analyzed. Additionally, the program VOSviewer, a tool for creating and visualizing bibliometric network, was used in order to best understand the development of the research in the studied area. Key-word maps were generated indicating occurrence and co-occurrence, which are represented by, respectively, the size of the circles and the quantity/size of the links. Also, the colors in these maps indicate clusters of related terms (network visualization) and the time distribution of the occurrences considering the period between 2010 and 2020 (overlay visualization).

Results

The number of documents published per year has risen exponentially over time since the first publication on the subject. Remarkably, most documents refer to the last few years, provided that 30% of the total was published between 2018 and 2021 (Fig. 1).

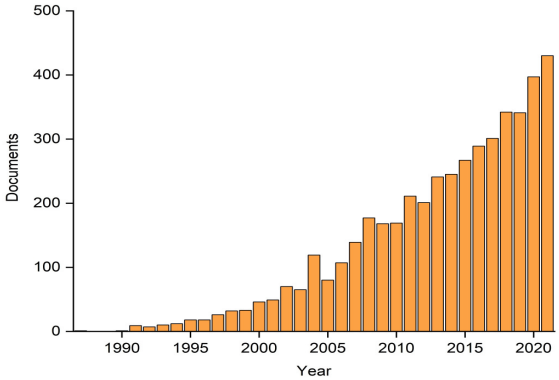

Figure 1: number of documents per year

The maps obtained through VOSviewer indicate the occurrence of 5 clusters, which were named: Land use change in agricultural frontiers (green); Soil biological quality (purple);

Greenhouse gasses in agriculture (yellow) and Fertility of tropical soils (blue; Fig. 2). Among these clusters, the first two are the most consolidated and occupy the bulk of the map. In this sense, organic matter, which is a part of the Soil management cluster, is the central key-word of the map, having the most citations. On the other hand, terms related with climate change and greenhouse gas emissions have little presence, indicating a lack of publications on the topic, which was already evidenced by Souza et al. (2021).

Three biomes are shown in the map: Cerrado, Amazon and Caatinga. The Cerrado biome establishes strong relations with the area of Soil management, mainly with the term no till. Therefore, the research is for the most part focused on agriculture. In contrast, Amazon in central in Land use change and is mainly connected with key-words about Amazon Forest itself. Lastly, Caatinga is the least relevant biome in the map, provided that it has little occurrence and weak relations with the central terms.

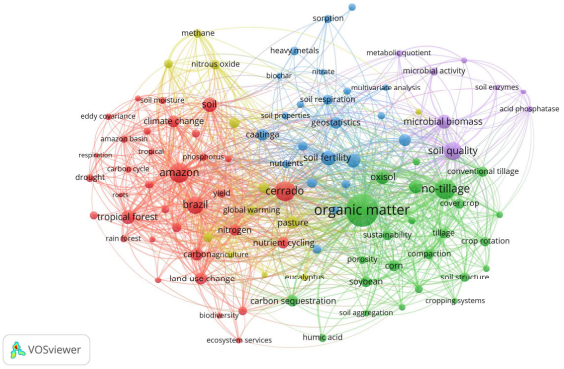

Figure 2: Map in network visualization

Considering the period of 2010 to 2020 (Fig. 2), the group of key-words related to Amazon is the oldest. Thus, the discussion about deforestation and land use change can be positioned in the beginning of this timeline. Next, a new period starts through a group that clusters organic matter, soil biological attributes and management of tropical soils, with emphasis on Cerrado. In this scenario, a twist can be observed in the research emphasis, which shifts from extensive to intensive agriculture, as evidenced by Dias et al. (2016). The terms from the next period refer to climate and land use change, soil quality and fertility, sustainability, carbon stocks, greenhouse gas emissions and compaction, marking the beginning of the discussion about sustainability in agriculture. The trend observed in this period complies with the growing discussion about the relation between agriculture and climate change, as well as the importance of preserving the soil resource.

Lastly, the most recent key-words and, consequently, still little cited are conservation agriculture, biochar and greenhouse gas emissions. On this basis, a continuity of the trends observed in the anterior period can be observed.

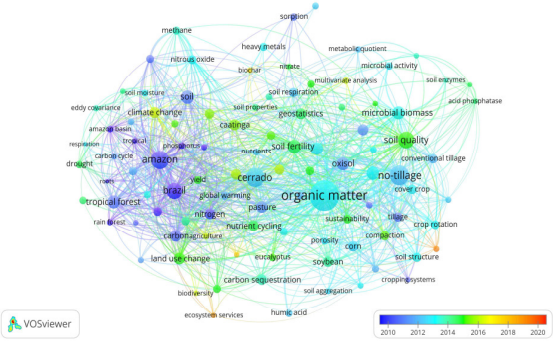

Figure 3: Map in overlay visualization

Conclusions

The expansion and evolution of Brazilian research in relation to the topics evaluated is notorious. Starting from studies on land use change, later emerged other topics related to agricultural intensification. Then, more recently topics related to sustainability in agriculture, considering climate change and soil preservation. This last study area, as it is still recent, is little explored and the scarcity of studies related to greenhouse gases stands out. Thus, we emphasize the importance of advancing these discussions, essential for the establishment of an increasingly sustainable agriculture in Brazil.

References

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