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Visualized Analysis of Research Progress on Soil Aggregates

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Abstract [**Objectives**] This study was conducted to gain an in-depth understanding of the research status of fields related to soil aggregates.

[**Methods**] The academic papers published from 2001 to 2020 in the field of soil aggregates were searched in the CNKI database serving as the statistical source using the subject terms "soil" and "aggregate" under advanced search, and visually analyzed by bibliometric statistical methods, from the perspectives of the annual number of published papers, the number of papers published by authors, and highly cited papers.

[**Results**] The trend of the number of published papers in the past 20 years was mainly divided into three stages: 2001–2007, 2008–2016, and 2017–2020. There were 192 first authors in the literature related to soil aggregates. The authors with the top 3 published papers were Wang Erli, Zhang Zhengxiong, Li Yangbing, and Yang Yonghui (tied for third). Three highly cited papers were published in journals related to "ecology", and the top 10 most cited papers focused on the "formation and stability" of soil aggregates and the relationship between aggregates and soil organic matter and biochar. [**Conclusions**] This study can provide reference for further research on soil aggregates.

Key words Core journals, Soil aggregate, Bibliometrics

1 Introduction

Soil structure is the basic physical property of soil. It refers to the arrangement and combination of soil particles, and is an important factor determining soil function, supporting plant and animal growth, and regulating environmental quality^[1]. Soil aggregates are an important part of soil structure, including aggregate particles of different particle sizes and pores of different sizes and shapes. They have "three major functions" in the soil, namely, ensuring and coordinating water, fertilizers, gas and heat in the soil, affecting the types and activity of soil enzymes, and maintaining and stabilizing the loose and mature soil layer^[2]. Therefore, soil aggregates have received more and more attention from scholars at home. In this study, based on CNKI's core journal database, the academic papers published in the field of soil aggregates in the past 20 years were counted using bibliometric statistical methods, from the perspectives of the annual number of published papers, the number of papers published by authors, and highly cited papers, and the research progress of soil aggregates was analyzed.

2 Data sources and methods

2.1 Data sources and search methods In the CNKI database

serving as the statistical source, we selected the advanced search method to search with the subject terms "soil" and "aggregate" within the time range from January 1, 2001 to December 31, 2020, under the Chinese core journal criterion of Peking University.

2.2 Data analysis A total of 2 591 papers related to soil aggregates in the past 20 years were searched. After removing irrelevant papers, 2 567 effective papers were finally obtained as research objects, and the data were exported for visual analysis.

3 Results and analysis

3.1 Distribution of annual publications From 2001 to 2020, the annual distribution of papers related to soil aggregates is shown in Fig. 1. In the past 20 years, a total of 2 567 related papers have been published, and the overall number of papers has been increasing year by year, with an average annual number of 128 published papers. The trend of the number of published papers was divided into three stages: from 2001 to 2007, during which the research on soil aggregates was in the initial exploratory stage, with an annual number of 24–88 published papers, and the average annual number of published papers was only 50; from 2008 to 2016, which was a stage of rapid development, with an annual number of 115–184 published papers, and an average annual number of 143 published papers, nearly three times that of the first stage, indicating that with the development of soil science, scholars at home had been paying more and more attention to soil structure and aggregates; and from 2017 to 2020, which was a stage of high-speed development, during which the number of published papers exceeded 200 in every of the four years, especially in 2020, when the number of published papers reached 269, with an increase of 11 times compared with 2001, indicating that the study of soil aggregates has become a hot spot in soil science.

3.2 Distribution of the number of published papers according to first authors The number of first authors who had published papers in the field of soil aggregates from 2001 to 2020 was

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counted, and a total of 1 925 first authors were searched. The number of papers they published was 1 – 11, and the authors who had published 1 paper were 1 538, accounting for 79.9% of the total number. The top 8 authors with the most published papers are shown in Table 1. These 8 authors published a total of 64 papers, accounting for only 2.5% of the total reference quantity, indicating that the research team on soil aggregates is relatively extensive. The top 3 authors were Wang Erli (11 papers), Zhang Zhengxiong (9 papers), Li Yangbing and Yang Yonghui (8 papers), of which only the top-ranked author published more than 10 papers. The author units were Liaoning Technical University, Fujian Agriculture and Forestry University, Guizhou Normal University, Henan Academy of Agricultural Sciences, Sichuan Agricultural University and other universities and research institutes. The areas where the units are located are distributed in the east, middle and west of China, indicating that there are many research teams on soil aggregates and the distribution range is wide.

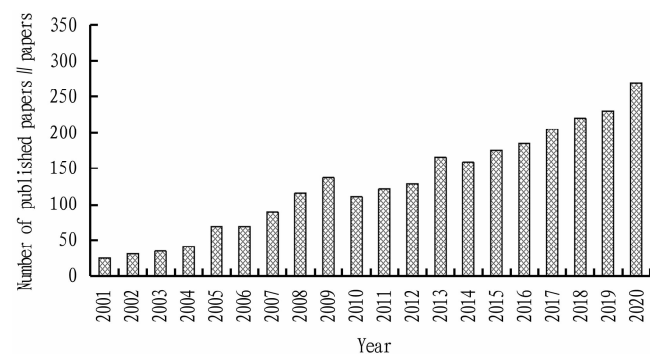


Fig. 1 Distribution of the annual number of published papers on soil aggregates

3.3 Distribution of highly cited papers The number of citations can reflect the research hotspots in the field of soil aggregates. The top 10 most frequently cited papers in the field of soil aggregates in China are shown in Table 2. These 10 papers were published in 8 journals, of which 3 are related to "ecology". The top 10 papers were all cited more than 367 times, and the highest cited frequency of the top-ranked paper was 546 times. The main research content of the top-ranked paper was the "formation and stability" of soil aggregates^[2]. Five of the top 10 cited authors were from different institutes of Chinese Academy of Sciences, indicating that the scholars from Chinese Academy of Sciences have paid great attention to soil aggregates and have a great influence. The highly cited papers focused on the relationship between aggregates and soil organic matter^[3-5] and biochar^[6-7].

Table 1 The top 8 authors with the most published papers

Rank	Author	Unit	Number of published papers
1	Wang Erli	Liaoning Technical University	11
2	Zhang Zhengxiong	Fujian Agriculture and Forestry University	9
3	Li Yangbing	Guizhou Normal University	8
4	Yang Yonghui	Henan Academy of agricultural sciences	8
5	He Shuqin	Sichuan Agricultural University	7
6	Wang Enheng	Northeast Forestry University	7
7	Zhang Baohua	Liaocheng University	7
8	Zheng Zicheng	Sichuan Agricultural University	7
Total	-	-	64

Table 2 Top 10 most cited papers on soil aggregates in China

No.	Paper title	The first author	Institution of the first author agency	Citation frequency	Published journals	Time
1	Forming and stable mechanism of soil aggregate and influencing Factors	Wang Qingkui	Shenyang Institute of Applied Ecology, Chinese Academy of Sciences	546	Chinese Journal of Soil Science	2005
2	A review on relationship between soil organic carbon pools and soil structure stability	Peng Xinhua	Institute of Soil Science, Chinese Academy of Sciences	492	Acta Pedologica Sinica	2004
3	The dynamics of soil organic matter in crop-land responding to agricultural practices	Yang Jingcheng	Institute of Botany, Chinese Academy of Sciences	491	Acta Ecologica Sinica	2003
4	Concepts and relative analytical techniques of soil organic matter	Wu Tianyun	Lanzhou University	466	Chinese Journal of Applied Ecology	2004
5	Study progress on factors affecting soil enzyme activity	Wan Zhongmei	Jilin Agricultural University	464	Journal of Northwest A&F University (Natural Science Edition)	2005
6	Effects of conservation tillage on soil aggregates in Huabei Plain, China	Zhou Hu	China Agricultural University	458	Scientia Agricultura Sinica	2007
7	Research progress on the effect of biochar on soil physicochemical properties	Wu Yu	Yantai Institute of Coastal Zone Research, Chinese Academy of Sciences	446	Advances in Earth Science	2014
8	Effects of biochar on properties of red soil and ryegrass growth	Huang Chao	Zhejiang University	444	Journal of Zhejiang University (Agriculture & Life Sciences)	2011
9	Core issues and research progresses of soil science of C sequestration	Pan Genxing	Nanjing Agricultural University	396	Acta Pedologica Sinica	2007
10	A review of affecting factors of soil nitrogen mineralization in forest ecosystems	Li Guicai	Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences	367	Acta Ecologica Sinica	2001

4 Conclusions

Through the bibliometric analysis of 2 567 papers from core journals in the field of soil aggregates from 2001 to 2020, the trend of the number of published papers in the past 20 years was mainly divided into three stages: 2001 – 2007, which was the initial exploratory stage, 2008 – 2016, which was a stage of rapid development, and 2017 – 2020, which was a stage of rapid development, during which with the emphasis on soil aggregates in China, the number of published papers from 2017 to 2020 exceeded 200. There were 192 first authors in the literature related to soil aggregates, and 1 538 authors published 1 paper, accounting for 79.9% of the total number of authors, indicating that the research team on soil aggregates is relatively extensive. The authors with the top 3 published papers were Wang Erli, Zhang Zhengxiong, Li Yangbing, and Yang Yonghui (tied for third). Three highly cited papers were published in journals related to "ecology", and the top 10 most cited papers focused on the "formation and stability" of soil aggregates and the relationship between aggregates and soil organic matter and biochar.

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the exchangeable calcium and exchangeable magnesium contents were low. The northern and southern dry farming regions are different in soil nutrients. Dry land where cassava and maize were planted had higher fertility. It is recommended to apply lime or alkaline fertilizers to acid dry soils to increase soil pH, increase soil calcium and magnesium supply. Organic fertilizer should be applied to improve soil water retention capacity, and it is necessary pay attention to the fertilization ratio of macroelements for balanced fertilization.

References

- [1] CHEN GF, HE MJ, WEI XH, *et al.* Properties of basic soil type and its improvement in Laos[J]. Tianjin Agricultural Sciences, 2016, 22(9): 5 – 10. (in Chinese).
- [2] JIANG L. Realistic dilemma of agricultural development in Laos and the sustainable development strategy of agricultural economy[J]. World Agriculture, 2016(2): 166 – 169. (in Chinese).
- [3] LU RH, XIA XZ, LIU KQ, *et al.* Current status of agricultural production in Laos[J]. Guangxi Agricultural Sciences, 2010, 41(12): 1358 – 1360. (in Chinese).
- [4] CHANG HY, ZHANG JB, ZHANG HJ, *et al.* China-Laos cooperation in

References

- [1] ZHANG XR, ZHANG WQ. Advance in soil aggregate study[J]. Northern Horticulture, 2020(21): 131 – 137. (in Chinese).
- [2] WANG QK, WANG SL. Forming and stable mechanism of soil aggregate and influencing factors[J]. Chinese Journal of Soil Science, 2005(3): 415 – 421. (in Chinese).
- [3] PENG XH, ZHANG B, ZHAO QG. A review on relationship between soil organic carbon pools and soil structure stability[J]. Acta Pedologica Sinica, 2004(4): 618 – 623. (in Chinese).
- [4] YANG JC, HAN XG, HUANG JH, *et al.* The dynamics of soil organic matter in cropland responding to agricultural practices[J]. Acta Ecologica Sinica, 2003(4): 787 – 796. (in Chinese).
- [5] WU TY, JEFF J SCHOENAU, LI FM, *et al.* Concepts and relative analytical techniques of soil organic matter[J]. Chinese Journal of Applied Ecology, 2004(4): 717 – 722. (in Chinese).
- [6] WU Y, XU G, LU YC, *et al.* Research progress on the effect of biochar on soil physicochemical properties[J]. Advances in Earth Science, 2014, 29(1): 68 – 79. (in Chinese).
- [7] HUANG C, LIU LJ, ZHANG MK. Effects of biochar on properties of red soil and ryegrass growth[J]. Journal of Zhejiang University: Agriculture & Life Sciences, 2011, 37(4): 439 – 445. (in Chinese).
- [8] Guangdong Soil Census Office. Soil in Guangdong Province[M]. Beijing: Science Press, 1993: 419, 448, 466. (in Chinese).
- [5] WANG D. Dilemma and countermeasures of agricultural development in Laos: On the contemporary situation and prospect of agricultural cooperation between china and Laos[J]. Journal of Anhui Agricultural Sciences, 2018, 46(7): 190 – 192. (in Chinese).
- [6] LIU ZQ, WANG B, MA CF, *et al.* The nutrient status of main soil types in the northern highland of Laos[J]. Chinese Journal of Tropical Agriculture, 2017, 37(1): 15 – 20. (in Chinese).
- [7] IKEURA H, PHONGCHANMIXAY S, CHOMXAYTHONG A, *et al.* Variation in lowland rice yield and its determinants in a rainfed area in Savannakhet Province, Laos[J]. Paddy and Water Environment, 2019(17): 121 – 130.
- [8] Guangdong Soil Census Office. Soil in Guangdong Province[M]. Beijing: Science Press, 1993: 419, 448, 466. (in Chinese).
- [9] LIU Z, TANG QZ, CHEN GF, *et al.* Analysis of soil nutrient under different types of land-use in Central Laos[J]. Journal of Southern Agriculture, 2012, 43(12): 1981 – 1985. (in Chinese).
- [10] CHUA MF, YOUNG LT, OUDTHACHIT ST, *et al.* Potassium fertilisation is required to sustain cassava yield and soil fertility[J]. Agronomy, 2020, 10(1103): 1 – 11.
- [11] FUJISAO K, KHANTHAVONG P, OUDTHACHIT S, *et al.* Impacts of the continuous maize cultivation on soil properties in Sainyabuli Province, Laos[J]. Scientific Reports, 2020(10): 11231, 1 – 9.