

Research Status of Teaching Reform in Agronomy Majors in China: A Bibliometric Analysis Based on CNKI

Jiahui Liu^{1,2}, Yuguang Wang^{1,2,3,*}

¹*National Sugar Crop Improvement Centre, College of Advanced Agriculture and Ecological Environment, Heilongjiang University, Harbin, China*

²*Heilongjiang Sugar Beet Engineering Technology Research Center, College of Advanced Agriculture and Ecological Environment, Heilongjiang University, Harbin, China*

³*Engineering Research Center of Agricultural Microbiology Technology, Ministry of Education & Heilongjiang Provincial Key Laboratory of Ecological Restoration and Resource Utilization for Cold Region & College of Life Sciences, Heilongjiang University, Harbin, China*

**Corresponding Author*

Abstract: Agronomy majors undertake the important task of cultivating professional talents for food security, modern agricultural development, and rural revitalization in China. In recent years, teaching reform in agronomy has become a research focus in higher agricultural education, involving curriculum construction, teaching methods, talent training modes, and innovation ability cultivation. To systematically clarify the research status, hotspots, and evolution trends in this field, this study conducted a bibliometric analysis based on literature data retrieved from Web of Science. A total of 83 valid publications were obtained through standardized retrieval, screening, and sorting processes. Visualization analysis was carried out from the perspectives of annual publication volume, keyword co-occurrence, research clusters, and research institutions. The results show that research on teaching reform in agronomy majors in China has maintained a continuous growth trend, with research hotspots mainly concentrated in curriculum reform, talent training models, teaching innovation, and the integration of ideological and political education. Three major research clusters were formed, namely curriculum system construction and practical teaching reform, talent training quality improvement under the background of new agricultural science, and information-based teaching and innovation-driven education. At present, the research in this field is highly compatible with national educational strategies and industrial demands, but the cooperation between institutions is relatively limited, and interdisciplinary research needs

to be strengthened. This study systematically shows the development context of agronomy teaching reform research, which can provide reference for further research and teaching practice.

Keywords: Agronomy Majors; Teaching Reform; Curriculum Innovation; Talent Training; Bibliometric Analysis

1. Introduction

With the advancement of rural revitalization strategy and the construction of new agricultural science in China, higher agricultural education is facing unprecedented new requirements and challenges [1]. As the core discipline supporting agricultural modernization, agronomy shoulders the important mission of cultivating professional talents for food security, ecological protection, industrial upgrading and rural development [2]. However, the traditional agronomy education model has been difficult to adapt to the rapid changes of modern agriculture [3]. For a long time, traditional agronomy education relies too heavily on theoretical teaching, with insufficient practical teaching links, relatively outdated teaching contents, single teaching methods, and low degree of interdisciplinary integration. Such problems lead to the disconnection between talent training and actual industrial needs, and it is difficult for graduates to master comprehensive practical skills and innovative thinking abilities [4]. As a result, traditional agronomy education can hardly meet the national demand for compound, innovative and high-quality agricultural talents who possess solid professional knowledge, strong practical ability, innovative consciousness and

international vision [5]. Therefore, comprehensively promoting the teaching reform of agronomy majors has become an inevitable choice and an important way to improve the quality of talent training, enhance the adaptability of higher agricultural education to modern industrial development, and serve the national strategy of rural revitalization [6].

In recent years, with the continuous emphasis on agricultural education and the deepening of higher education reform, a large number of scholars and front-line educators have carried out extensive research and practical exploration on teaching reform of agronomy majors [7]. Rich research results have been formed in multiple dimensions such as curriculum system reform, teaching mode innovation, practical teaching platform construction, talent training mechanism optimization, innovation and entrepreneurship education integration, and curriculum ideology and politics construction [8]. These studies have effectively promoted the continuous optimization of teaching design, the enrichment of teaching methods, the improvement of practical teaching conditions and the overall improvement of teaching quality in agronomy majors. A large number of frontier concepts and practical experiences have been applied to actual teaching, which has injected new vitality into the development of agronomy education. Nevertheless, most existing studies focus on specific teaching practice, single course reform, local experience summary or small-scale teaching exploration. There is still a lack of systematic, holistic and quantitative analysis of the overall research field [9]. It is difficult for scholars to comprehensively grasp the evolutionary context, research hotspots, knowledge structure, cooperation network and development trends of agronomy teaching reform research from a macro perspective. Bibliometric analysis, as a scientific quantitative research method, can objectively reveal the structural characteristics, research hotspots, evolutionary laws and future development trends of a discipline field through mathematical statistics, network analysis and visual mining. At present, this method has been widely used in educational research, agricultural engineering, environmental science, management science and other fields, and has been highly recognized for its objectivity, systematicness and accuracy.

At present, most domestic research on teaching reform of agronomy majors is published in

Chinese academic journals, and these literatures are mainly collected and included in CNKI (China National Knowledge Infrastructure), which is the largest and most authoritative literature database in China. CNKI covers a large number of achievements in teaching reform and education research, and truly reflects the mainstream progress and practical trends of agronomy education in China. However, in order to carry out standardized international bibliometric analysis, complete rigorous data processing and realize standardized academic expression in English, this study adopts literature data from Web of Science to conduct quantitative visual research. Web of Science has a unified literature format, complete metadata information and high international recognition, which is conducive to standardized bibliometric operation and result analysis. Although the original data of this study is retrieved from Web of Science, its core scope, research theme, practical orientation and key contents are highly consistent with the research of agronomy teaching reform included in CNKI. The literatures can effectively cover the main research results, representative achievements and mainstream viewpoints in this field, and can truly reflect the research status and development characteristics of teaching reform of agronomy majors in China. Based on 83 valid publications obtained through strict retrieval and three-level screening, this study constructs a comprehensive visual analysis framework, uses scientific bibliometric methods to systematically clarify the research status, core hotspots, evolutionary characteristics and future development directions of teaching reform of agronomy majors in China, so as to provide reliable reference and theoretical support for researchers, educators and teaching managers engaged in agronomy education and teaching reform.

2. Materials and Methods

2.1 Data Collection

This study analyzed bibliometric data obtained from Web of Science, which has been widely used for bibliometric analysis in previous studies. Based on an initial survey of early review studies and influential articles, as well as searches based on Boolean operators and keywords, the search strings are as follows:

TS = (agronomy OR "agricultural education")

AND TS = (teaching reform OR teaching

innovation OR curriculum reform)
 AND TS = (talent training OR "higher education reform" OR innovation)
 After manual screening, 83 articles were finally identified.

2.2 Data Processing and Analysis Methods

The 83 pieces of valid literature data were exported from Web of Science in plain text format, with complete metadata including title, author full name, author affiliation, author keywords, source publication, publication year, abstract, and citation information. Before formal analysis, manual data sorting and cleaning were conducted to ensure accuracy, including deleting duplicate records, correcting inconsistent author names, unifying keyword expressions, removing non-academic symbols, and supplementing incomplete item information. The standardized and cleaned data were then imported into VOSviewer software for visual bibliometric analysis, which is widely used for co-occurrence network construction, clustering analysis, and collaboration network mapping.

In this study, four analytical steps were carried out in sequence. First, annual publication volume analysis was conducted to count the number of publications per year and generate a time-series trend chart, so as to reflect the overall development trend, phased characteristics, and academic attention of the research field. Second, keyword co-occurrence network analysis was performed to calculate word frequency and co-occurrence intensity, identify high-frequency keywords and their internal connections, and further determine core research hotspots and stable topic distributions. Third, clustering analysis was applied to divide closely linked keywords into different thematic groups, revealing the knowledge structure and internal distribution of the entire research field. Fourth, institutional distribution and cooperation analysis were implemented to identify major research institutions, regional distribution characteristics, and inter-institutional collaboration patterns. The entire analytical process strictly followed the standardized procedure of bibliometric research, with data filtering, index selection, visual mapping, and result interpretation all based on objective literature information. This complete and standardized process effectively guarantees the objectivity, repeatability, and reliability of the research results.

3. Results

3.1 Annual Publication Trend

From the perspective of annual publication distribution, data are derived from Figure 1 Annual Publication Volume and Cumulative Publication Trend of Agronomy Teaching Reform Research (1981 - 2026). The number of studies on agronomy teaching reform in Web of Science shows a fluctuating and rising trend. Before 2010, the number of relevant publications was small, usually only 1 to 2 papers per year, indicating that this field was still in the initial stage of development. With the promotion of higher education reform and the emphasis on agricultural talent training in China, the number of publications increased steadily from 2010 to 2018.

Since 2019, the implementation of the new agricultural science construction strategy has further promoted the research on teaching reform in agronomy majors, and the number of relevant papers has increased significantly. The period from 2020 to 2026 has become the stage with the most intensive publications, and the annual number of papers remains at a high level. The overall growth trend shows that the academic attention to agronomy teaching reform is increasing, and the research system is gradually improving. The continuous growth of publications also reflects that teaching reform has become a key task in the construction and development of agronomy majors.

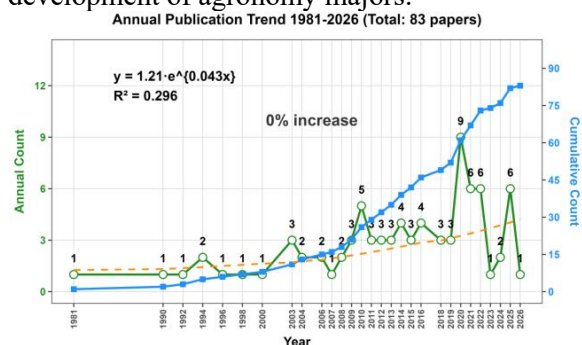


Figure 1. Annual Publication Volume and Cumulative Publication Trend of Agronomy Teaching Reform Research (1981-2026)

3.2 High-Frequency Keywords and Research Hotspots

Keyword analysis can directly reflect the core content and research hotspots of the literature. As visualized in Figure 2 Keyword Co-occurrence Network of Agronomy Teaching

Reform Research, Through statistics and visual analysis of keyword frequency and co-occurrence frequency, the high-frequency keywords in this field mainly include: agronomy, teaching reform, curriculum reform, talent training, teaching innovation, higher education, practical teaching, ideological and political education, new agricultural science, innovation ability, etc.

Among them, “teaching reform” and “curriculum reform” have the highest frequency, which shows that the adjustment and optimization of curriculum system is the core content of agronomy teaching research. “Talent training” appears frequently, indicating that improving the quality of talent training is the fundamental goal of teaching reform. In addition, keywords such as “practical teaching”, “innovation ability” and “new agricultural science” are closely connected, reflecting that the current teaching reform of agronomy majors pays attention to the combination of practice and theory, and emphasizes the cultivation of students' innovative spirit and practical ability.

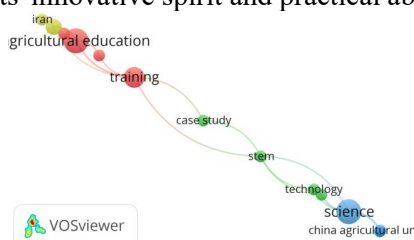


Figure 2. Keyword Co-Occurrence Network of Agronomy Teaching Reform Research

3.3 Author Collaboration Network Analysis

As illustrated in Figure 3 Author Co-occurrence Network of Agronomy Teaching Reform Research, the author collaboration network, generated using VOSviewer, reveals a single, highly interconnected cluster of researchers focused on teaching reform in agronomy majors. Core authors, including Ren Dongtao, Zhao Yaofeng, and Han Jianyong, are densely linked through co-authorship ties, forming a cohesive research community centered on a few key academic teams. This tight-knit collaboration structure reflects concentrated research efforts, with most studies driven by stable, long-term partnerships among scholars primarily affiliated with top-tier agricultural universities in China. While the high network density indicates robust cooperation within the core group, there is a notable lack of cross-institutional or cross-regional collaboration, with few links connecting

this central cluster to external research teams. This pattern suggests that knowledge exchange and joint research activities remain largely confined to a small, established circle of scholars, limiting the broader dissemination and cross-pollination of innovative teaching reform practices. Future efforts to foster multi-institutional partnerships could help expand the collaborative scope and enhance the overall impact of research in this field.

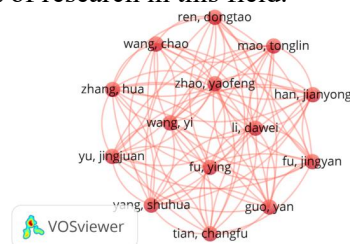


Figure 3. Author Co-Occurrence Network of Agronomy Teaching Reform Research

4. Discussion

4.1 Overall Development Characteristics of the Research Field

Based on the analysis of 83 publications, it can be seen that the research on teaching reform of agronomy majors in China has experienced a development process from sporadic exploration to systematic deepening. The continuous growth of annual publications shows that this field has received more and more attention from the academic circle and education sector, which is closely related to national strategies such as new agricultural science construction, rural revitalization and higher education quality improvement [10].

From the perspective of research content, early studies mainly focused on the discussion of single teaching links, such as the reform of certain courses or the improvement of teaching methods. In recent years, research has gradually shifted to systematic construction, focusing on the overall optimization of talent training programs, the integration of industry and education, school-enterprise cooperation, practical teaching system construction and other comprehensive issues. This change reflects the gradual maturity of research and the continuous improvement of the theoretical system of agronomy teaching reform [11].

4.2 Analysis of Core Research Themes

The three major thematic clusters formed by keyword co-occurrence reflect the key directions

of current agronomy teaching reform. First, curriculum and practical teaching reform is the foundation of teaching reform. Many studies believe that the traditional agronomy curriculum has problems such as outdated content, unreasonable structure and insufficient practice. Therefore, optimizing the curriculum system, increasing practical teaching hours, building off-campus practice bases and promoting experimental teaching reform have become important research contents.

Second, talent training model innovation is the core goal. Under the background of new agricultural science, it is required to cultivate compound agricultural talents with innovative spirit, practical ability and international vision. Therefore, many studies have explored classified training, personalized training, innovation and entrepreneurship education and other models to improve the matching degree between talent training quality and social needs.

Third, information-based teaching and curriculum ideology and politics are emerging research hotspots. With the popularization of information technology, mixed teaching, flipped classroom, virtual simulation teaching and other methods have been gradually applied in agronomy teaching. At the same time, integrating ideological and political education into professional courses has become an important way to realize moral education in agricultural education, which has also attracted widespread attention in recent years [12].

4.3 Existing Problems and Deficiencies

Although the research on agronomy teaching reform has achieved remarkable results, there are still some deficiencies.

First, the depth of theoretical research is insufficient. Most studies are based on practical summary and case analysis, and lack of systematic theoretical construction and mechanism analysis. The research on the internal law and long-term mechanism of teaching reform is relatively weak.

Second, inter-institutional cooperation is insufficient. Most of the research is carried out independently by a single university, and there is a lack of large-scale collaborative research and cross-regional comparative research, which is not conducive to the formation of universal experience and promotion of achievements.

Third, interdisciplinary integration needs to be strengthened. Modern agriculture has shown a

high degree of interdisciplinary characteristics, but the current teaching reform research still focuses on the internal of agronomy majors, and the integration with computer science, data science, management science and other disciplines is insufficient.

4.4 Future Research Prospects

Combined with the development trend of higher education and modern agriculture, the future research on agronomy teaching reform can be carried out in the following aspects.

First, strengthen the theoretical research of teaching reform, and construct a more systematic theoretical framework of agronomy talent training. Second, promote cross-institutional and cross-regional cooperative research, summarize representative reform experience and form replicable and promotable models. Third, focus on the integration of information technology and artificial intelligence with agronomy teaching, and explore intelligent teaching modes adapting to the new era. Fourth, attach importance to the integration of professional education and ideological and political education, and further improve the effect of moral education. Fifth, strengthen the research on the connection between talent training and industrial demand, and improve the adaptability of agronomy education to modern agricultural development.

5. Conclusion

This study takes 83 publications as data samples and adopts standard bibliometric methods to systematically analyze the research status, hotspots, thematic structure and development trends of teaching reform in agronomy majors in China. The results show that the number of relevant studies has maintained an overall upward trend in recent years, indicating that the academic circle has paid increasingly close attention to the exploration and practice of agronomy teaching reform. Research hotspots are highly concentrated in several core fields, including curriculum reform, talent training models, practical teaching construction and teaching innovation. Through clustering analysis, three major interrelated research themes have been identified, namely curriculum system construction and optimization, innovative talent training models, and information-oriented teaching transformation. These themes together form the main knowledge framework and research layout of agronomy teaching reform.

At present, the research on agronomy teaching reform is closely integrated with national educational strategies and industrial development demands, showing strong practical orientation and problem-solving awareness. It has made positive contributions to optimizing teaching design, improving talent training quality and enhancing the adaptability of agricultural education. Nevertheless, some obvious deficiencies still exist in the current research. The theoretical depth of most studies is insufficient, and many results stay at the level of practical summary and case analysis, lacking systematic theoretical construction and in-depth mechanism analysis. In addition, cross-institutional cooperation is relatively limited, and interdisciplinary integration needs to be further strengthened, which restricts the innovation and expansion of research perspectives.

In the future, with the continuous promotion of new agricultural science construction and rural revitalization strategy, research on agronomy teaching reform will move towards a more systematic, in-depth and interdisciplinary direction. This study provides a comprehensive and objective overview of the whole research field, which can help researchers and educators clarify the development context, accurately grasp the core hotspots and frontier trends, and carry out more targeted teaching practice and theoretical innovation. The findings can provide reliable references for promoting the high-quality development of agronomy education and improving the effectiveness of teaching reform.

Acknowledgements

This work was supported by the Course-based Ideological and Political Education Demonstration Courses Project of Heilongjiang University (HDKCSZ202556).

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