

# Research Progress, Hot Spots and Prospects in the Field of Agricultural Innovation in China

## ——CiteSpace analysis based on 2258 articles

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**Abstract**—Agricultural innovation is an important force driving the high-quality development of agriculture. Based on 2258 articles in China National Knowledge Infrastructure(CNKI) core journal database, and using Cite-Space software, we investigated the research progress, research hotspots and changes in the field of agricultural innovation in China from 2005 to 2020, trying to clarify the research trends and frontiers in the field of agricultural innovation. The results show that: ① The number of publications in the field of agricultural innovation in China presents an overall trend of "increasing volatility in the early stage, a short-term decline in the medium-term, and a rapid rebound in the near term", but the cooperative research between authors and institutions is relatively weak; ②The hotspots of agricultural innovation research focus on technology Innovation, institutional innovation, innovation evaluation and modern agriculture, etc., and show phase characteristics; ③The evolution of research hot topics in the field of agricultural innovation in China reflects a strong background of the times. Therefore, in the future, interdisciplinary research will be a new hotspot and direction in the field of agricultural innovation. It is urgent to carry out systematic research on theories, methods, and applications, and strengthen the research on the integration of agricultural innovation and practice.

**Keywords**—agricultural innovation; Cite Space analysis; research progress; research hotspots; research prospects

### I. INTRODUCTION

Agricultural innovation is an important driving force for achieving high-quality agricultural development. At present, the main contradiction of China agricultural development has changed from insufficient total quantity to structural contradiction. However, it is a general consensus that the quality of China agricultural economy is low. It is urgent to improve the quality of agricultural economy. How to give full play to the driving role of agricultural innovation remains to be further explored.

It is generally believed that innovation factors have a positive impact on the high-quality development of the agricultural economy. However, traditional agricultural innovation research reviews mainly rely on reading a large number of documents and systematically reviewing them. The documents read are limited and inevitably subjective, and cannot clearly grasp the development process and relationship context of the field, and these complex relationships It can effectively catalyze the generation of new knowledge, while providing hotspot analysis and cutting-edge exploration directions, pointing out the

research focus and direction of this field for scientific and technological workers, and improving scientific research efficiency. With the help of Cite-Space software for bibliometric analysis, these problems can be avoided. Based on this, this research attempts to use Cite-Space visualization software to provide a basis for follow-up research in the field of agricultural innovation in China.

### II. DATA AND METHODS

#### A. Research tools and methods

This research uses Cite-space5.1.R6 version software to set the initial parameters, set the time span to 2005-2020, select the Node Type visualization node "Author", set the threshold to "TOP50", and time slice "per slice 1" ", the other options default, through the co-citation analysis theory and pathfinding network algorithm, respectively select the author (author), institution (institution) and keywords (keyword) as node types (node types) to generate a co-occurrence map, and then cooperate from the author systematic analysis of the development trend, key areas and research hotspots of agricultural innovation research in terms of network, institutional cooperation network, keyword network, keyword emergence, etc., in order to provide direction and reference for follow-up related research[1].

#### B. Data sources

Based on the CNKI core journal database of CNKI, search for subject terms such as "agricultural innovation", "agricultural technology innovation", and "agricultural innovation resources", the time range is 2005-2020, and a total of 2655 records were retrieved. However, due to the huge amount of literature related to the subject, the quality is uneven, and the degree of fit varies greatly. Therefore, the core journals were used as the source journals to refine the data, and the documents such as reports and book reviews were eliminated, and finally 2,258 valid documents were obtained, and then the document visualization analysis was carried out on this basis.

### III. ANALYSIS OF RESEARCH PROGRESS IN THE FIELD OF AGRICULTURAL INNOVATION

#### A. Analysis of the number of articles issued

The annual statistical analysis of the number of articles and the distribution of topics can intuitively reflect the degree of importance the academic community attaches to a certain research field, reveal the development status, and

predict the research prospects of the agricultural innovation field [2]. Generally speaking, the more articles are published, the more active the research in this field is. Through the time distribution of relevant literature in the field of agricultural innovation research, we can basically understand the degree of domestic research activity in the field of agricultural innovation (see Figure 1). In general, since 2005, the number of publications in the field of agricultural innovation in China has shown a trend of "increasing volatility in the early period, a short-term decline in the mid-term, and a rapid rebound in the near term", basically showing the "N-type" characteristics. Among them, the number of articles issued increased from 77 in 2005 to 166 in 2020, an increase of 115.58%. The average amount of articles issued from 2005 to 2020 was 150, indicating that the field of agricultural innovation has maintained a high degree of research enthusiasm, and after 2018, the number of publications has shown a rapid upward trend, rising from 98 in 2018 to 166 in 2020, an increase of 69.39%, which further reflects that the current agricultural innovation field is still receiving strong attention and will remain one of the important research focuses in the future.

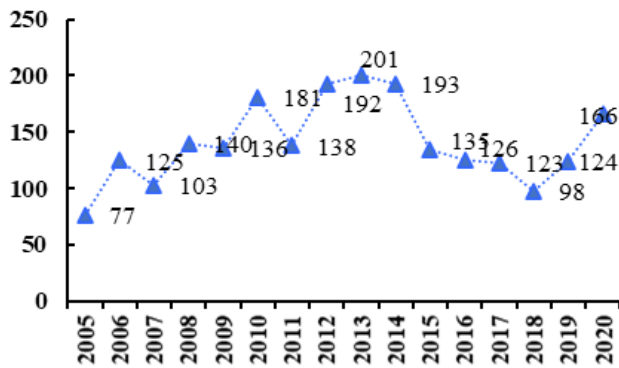


Figure 1. Number of research papers issued in the field of agricultural innovation in China from 2005 to 2020.

### B. Analysis of Author's Collaboration Network

Prolific authors in the author cooperation network refer to the most active and fruitful scholars in this field, as well as those who have made important contributions to the research in this field within a certain period of time [3]. It is generally believed that the author's name in the knowledge graph and the size of the node circle are proportional to the amount of author's research on the topic. The number of nodes represents the number of core authors under the selected parameter combination, and the number of connections represents the number of authors between authors. The degree of cooperation, the number of connections and the closeness of the cooperative relationship show a positive relationship [4]. A map of authors' cooperation in the field of agricultural innovation research in my country since 2005 was drawn (see Figure 2), and a total of 225 nodes and 178 connections were found, with a network density of 0.0071. The number of connections is less than the number of nodes, indicating that authors in the field of agricultural innovation The cooperative relationship between them is relatively weak, and only a small number of relatively stable cooperative teams have been formed, and there is a lack of effective cooperation mechanisms and leading figures. The

cooperative research between the authors needs to be improved.

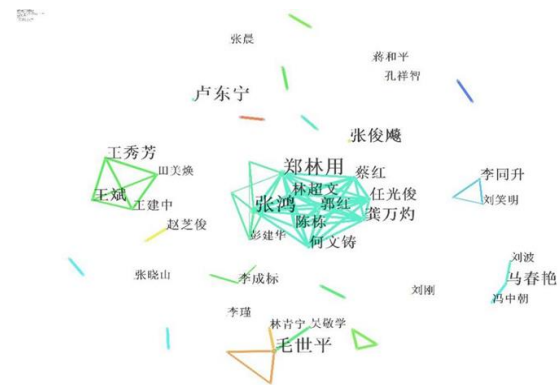


Figure 2. Authors' cooperation map in the field of agricultural innovation in China from 2005 to 2020.

Since each node in the graph represents an author, by observing the size of the node and the thickness of the connection, the amount of articles published by the authors and the intensity of cooperation between authors can be reflected [5]. Further analysis of Figure 2 shows that the cooperation network between authors has two major characteristics: First, judging by the number of posts and the size of the nodes, since 2005, there have been a number of agricultural innovation research fields such as Zhang Hong, Zheng Linyong, Mao Shiping, and Zhang Junbiao. The core authors represented by Ma Chunyan, Ma Chunyan and Ren Guangjun have found that there are relatively few author teams with a certain degree of cooperation. Second, the cooperative relationship among authors in the field of agricultural innovation generally shows the characteristics of "overall dispersion and partial concentration". Most authors are in a state of independent research, and only a few authors have established cooperative relations, and mainly single-line cooperation. It reflects the urgent need to strengthen cooperative research among scholars in the field of agricultural innovation.

### C. Analysis of the cooperation network between research institutions

The analysis of core academic institutions helps to grasp the distribution of academic resources at a macro level, and is conducive to the targeted supply and optimal allocation of academic resources. Use Cite-space software to obtain a co-occurrence map of research institutions (see Figure 3), where the number of nodes represents the number of core authors proposed under a specific parameter combination, and the number of connections represents the degree of cooperation between institutions under the subject. In the knowledge map the size of the institution's name and the size of the node circle are directly proportional to the amount of research published by the author on the topic. The map has 161 nodes, 38 connections, and a network density of 0.003, indicating that there are many research institutions in the field of agricultural innovation in my country, but the cooperation between research institutions is still relatively weak.



Figure 3. China's cooperation map of agricultural innovation research institutions from 2005 to 2020.

Note: Due to space reasons, only the organizations mentioned in the text are listed:

中国农业科学院农业经济与发展研究所: the Institute of Agricultural Economics and Development of the Chinese Academy of Agricultural Sciences; 华中农业大学经济管理学院: the School of Economics and Management of Huazhong Agricultural University; 中国人民大学农业与农村发展学院: the School of Agriculture and Rural Development of Renmin University of China

Further analysis of figure 3 shows that colleges and universities and scientific research institutions are the main research forces. Among them, the Institute of Agricultural Economics and Development of the Chinese Academy of Agricultural Sciences, the School of Economics and Management of Huazhong Agricultural University and the School of Agriculture and Rural Development of Renmin University of China are the most prominent. Research institutions represented by three institutions have made great contributions to agricultural research. The research directions of these research institutions are all agricultural economics, and they have played a leading role in agricultural economic research in the field of agricultural innovation in my country. Relatively speaking, other the distribution of research institutions is relatively scattered, indicating that the exchanges and cooperation between institutions are relatively weak. In the future, the field of agricultural innovation should increase cooperation between institutions. Collaborative papers can better bring together the wisdom of different scholars or the research characteristics of different research units. The cooperation will form a more complex knowledge structure, a more diverse range of topics, and more. Cross-cutting research perspectives, more multidisciplinary theoretical models and research methods, etc., are all conducive to improving the quality of collaborative papers [6].

#### IV. RESEARCH HOTSPOTS IN THE FIELD OF AGRICULTURAL INNOVATION AND ANALYSIS OF THEIR EVOLUTION

##### A. High-frequency keywords

In a certain field, if one or several keywords are found repeatedly in numerous documents, then the topics represented by these keywords are the research hotspots in this field [7]. Use Cite-space software to obtain 2258 key word co-occurrence maps in the field of agricultural innovation (see Figure 4), obtain a total of 364 nodes, 731 connections, network density 0.0611, index  $Q = 0.8798$ , greater than 0.3.  $S = 0.5555$ , greater than 0.5, indicating that the clustering result is reasonable. Further analysis believes that the number of connections is far greater than

the number of nodes, reflecting the relatively close relationship between the keywords of the research topics, and the formation of natural clustering of keywords represented by technological innovation, modern agriculture, agricultural innovation, technological innovation, etc. To a certain extent, reflects the research focus and hot spots in the field of agricultural innovation in my country. From the point of view of the network density of 0.0611, although many researches have been carried out on agricultural innovation, the depth of research still needs to be further explored.

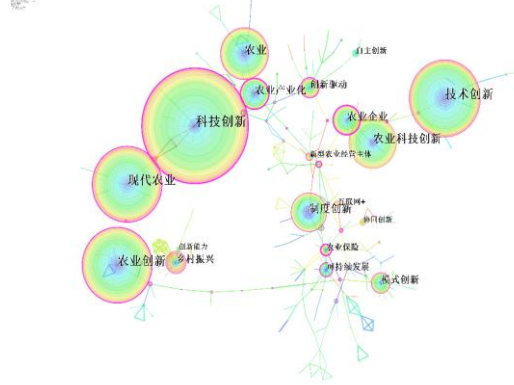


Figure 4. A map of research keywords in the field of agricultural innovation in China from 2005 to 2020.

Note: Chinese and English are as follows

科技创新: scientific and technological innovation; 现代农业: modern agriculture; 农业创新: agricultural innovation, 农业产业化: agricultural industrialization; 农业企业: agricultural enterprises; 创新驱动: innovation drivers; 农业保险: agricultural insurance; 技术创新: technological innovation; 乡村振兴: Rural revitalization; 可持续发展: sustainable development; 制度创新: institutional innovation; 互联网+: Internet +; 可持续发展: sustainable development; 协同创新: collaborative innovation; 新型农业经营主体: new agricultural business entities; 自主创新: independent innovation.

Analyzing the size and color depth of each node in the keyword map of the agricultural innovation research field, it is concluded that the nodes of agricultural scientific and technological innovation are much larger than other nodes, indicating that scientific and technological innovation plays an important role in the field of agricultural innovation[8]. In addition, the outer circles of scientific and technological innovation, technological innovation, modern agriculture, agricultural innovation, agricultural industrialization, agricultural enterprises and innovation drivers, and agricultural insurance are all in red, indicating that these keywords have received continuous attention in recent years. On this basis, the cluster analysis of keywords can get five larger clusters of "agricultural technology innovation", "agricultural system innovation", "agricultural modernization", "agricultural industrialization" and "agricultural bio-industry". The category label reflects that these five themes are important research hotspots in the field of agricultural innovation research.

##### B. Changes in research topics

According to the Cite-space software, the keyword co-occurrence time zone network mutation analysis diagram can be drawn, and you can find the changes in research topics in a certain field and judge the research trend in a certain field [9]. The general experience believes that the darker the color of the node in the network mutation

analysis graph of the keyword co-occurrence time zone, the more active the corresponding keyword is in the near future [10]. Therefore, by drawing the Time-zone map of the key words in the field of agricultural innovation research (see Figure 5), the evolution trend of hot topics in agricultural innovation research can be determined.

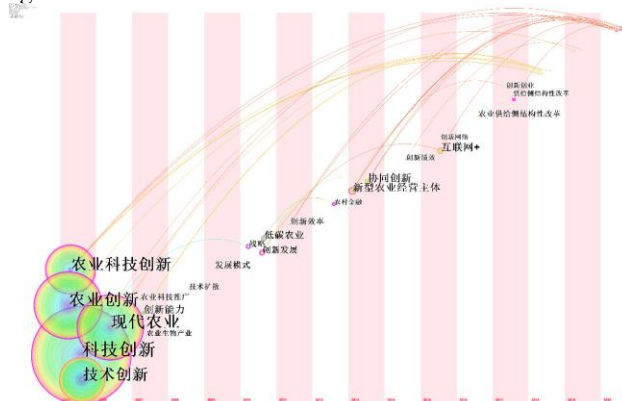


Figure 5. Time-zone map of keywords in the field of agricultural innovation research in China from 2005 to 2020.

Note: Chinese and English are as follows

农业科技创新:agricultural scientific and technological innovation;农业创新:agricultural innovation;现代农业:modern agriculture;科技创新:scientific and technological innovation;技术创新:technological innovation;低碳农业:low-carbon agriculture;农业金融:agricultural finance;新型农业经营主体:new agricultural business entities;协同创新:collaborative innovation;互联网+:Internet +;农业供给侧结构性改革:agricultural supply-side structural reform;技术扩散:technology diffusion;农业生物产量:agricultural biological output;发展模式:development model;创新效率:Innovation efficiency;创新绩效:Innovation performance;创新网络:Innovation network.

On the basis of analyzing figure 5 and studying related literature, it can be found that the changes in research hotspots in the field of agricultural innovation mainly show the following characteristics: First, in 2005, the amount of research literature related to popular topics was large and high-quality, such as "Science and Technology Innovation", "Technical Innovation", "Modern Agriculture", etc., have laid a solid foundation for the field of agricultural innovation, and these keywords have continued to this day, indicating that the hot topics in the field of agricultural innovation have a strong continuity. Second, the hot research in the field of agricultural innovation reflects strong characteristics of the times, and is closely related to the country's agricultural policies. "Agriculture", "ecological circular agriculture", etc., after 2015, "Internet+", "innovation network", and "rural supply-side structural reform" have become high-frequency keywords. Third, in recent years, although keywords worthy of attention have appeared, due to the short research time, the performance of the research results in the time-zone is not obvious, and further analysis is needed through keyword highlighting.

## V. RESEARCH CONCLUSIONS AND PROSPECTS

### A. Conclusions

First, the number of publications in the field of agricultural innovation in China shows an overall trend of "increasing volatility in the early period, a short-term decline in the mid-term, and a rapid rebound in the near term", but the cooperative research between authors and institutions is relatively weak..

Second, the research hotspots of agricultural innovation focus on technological innovation, institutional innovation, innovation evaluation, and modern agriculture, etc., and they show phased characteristics. The five themes of agricultural technology innovation, agricultural system innovation, agricultural modernization, agricultural industrialization and agricultural bio-industry are important research hotspots in the field of agricultural innovation research.

### B. Research outlook

At present, China's agricultural innovation work is still advancing continuously.

The systematic research on theories, methods and applications in the field of agricultural innovation urgently needs to be further improved. Research in the field of agricultural innovation focuses more on "what is agricultural innovation" and "how to achieve agricultural innovation". There is relatively little research on "why agricultural innovation". For example, "how agricultural innovation can achieve rural revitalization under the new development pattern" "How does the quality of agricultural innovation promote the high-quality development of agricultural economy", in-depth exploration of these issues is not enough, and systematic exploration from multiple dimensions such as theoretical origin, method verification, and application practice is needed.

## REFERENCES

- [1] Chen Chaomei, Chen Yue, Hou Jianhua, et al. Cite Space II : Identification and visualization of new trends and new developments in scientific literature[J]. Journal of Information, 2009.
  - [2] Yang Ming, Ye Qing, Jin Jing. Bibliometric analysis of agricultural development research from 1900 to 2010 [J]. Theory and Modernization, 2012, 000(004): 120-126.
  - [3] Geng Liuli, Li Na, Wang Qi, Jin Wei. Analysis of my country's Rural Industrial Convergence Science Knowledge Graph——Based on CNKI Core Journals and CSSCI Data from 2014 to 2018 [J]. Journal of Xichang College (Social Science Edition), 2019, 31(04):67-72+113.
  - [4] Liu Shuai, Junhong Wu. Visualization Analysis of Domestic College Counselors in Recent 20 Years Based on Cite Space[J]. International Journal of Higher Education Teaching Theory,2020,1(4).
  - [5] Zhang Hong, et al. The construction framework and operating mechanism of the Sichuan innovation team in the national modern agricultural industrial technology system[J]. Science and Technology Management Research, 2010, 30(09): 70-72+84.
  - [6] Mao Shiping, Yang Yanli, Lin Qingning. The evolution and effect evaluation of my country's agricultural science and technology innovation policies since the reform and opening up: empirical evidence from my country's agricultural scientific research institutions[J]. Issues in Agricultural Economics, 2019(01): 73-85.
  - [7] Wang Bin, et al. On the construction of the theoretical system of agricultural science and technology venture capital [J]. Jiangsu Agricultural Sciences, 2014, 42(04):387-391.
  - [8] Wang Xiufang, Yu Shusheng, Sun Yujie. Research on the External Environmental Issues of Agricultural Structural Adjustment[J]. Issues of Agricultural Economics, 2002(11): 16-19.
  - [9] Tang Yun Xu,Hai Ni Qu,San Shan Zhao,Mei Xia Zhang,Xiu Yang,Xu Yan Huang. The Visualization Analysis of Research Hotspot and Frontier Technology of the Smart Power Distribution and Utilization Based on the Cite Space[J]. Energy and Power Engineering,2017,9(4B).
- Chen Peng, Tian Yang. Analysis of Research Hot Spot and Trends of Bioinformatics Based on Cite Space[J]. Nanoscience and Nanotechnology Letters,2018,10(11).