



中国农业科学院
农业信息研究所

Agricultural Information Institute of CAAS



Analysis and evaluation of global agricultural technology competitiveness based on paper and patent output

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Reporting Content

0. Introduction to our main research work
1. Analysis of agricultural international scientific research competitiveness based on paper output
2. Analysis of agricultural discipline evaluation and competitiveness based on paper output
3. Analysis of agricultural technology competitiveness based on patent output

Agricultural science and technology development trend and technology forecast analysis

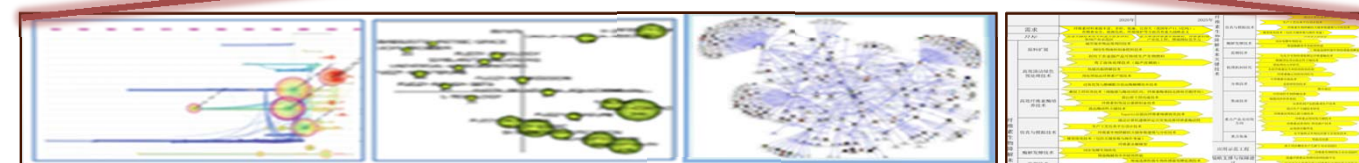
科技决策

Main content

- Analysis and research on the development trend of agricultural science
- Agricultural technology forecast analysis

Main products

1. 《动物资源与育种领域发展态势分析》
2. 《2016农业研究前沿》
3. 《纤维素生物裂解技术预见分析》
4. 《生物固氮与土壤肥力提升》



✓ 自然语言处理
✓ 文本挖掘
✓ 知识组织
✓ 机器学习
✓ 主题识别
✓ 语义网

分析方法体系

- ◇ 文献计量
- ◇ 引文分析
- ◇ 复杂网络
- ◇ 技术路线图
- ◇ 德尔菲法

分析指标体系

- ◇ 主题识别指标
- ◇ 社区网络识别指标
- ◇ 路径识别指标
- ◇ 前沿识别指标
- ◇ 颠覆性技术识别指标
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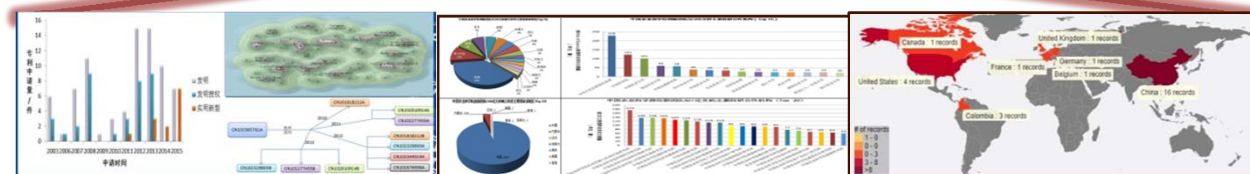
研究云（学科、领域、技术等）

定性定量计量

科技数据：科技文献、专利文献、网络资源等

Comprehensive competitiveness analysis and discipline evaluation of agricultural science and technology

科技管理决策



Main content

- The global level
- Institutional level
- Research team level

Main products

1. 《315创新团队竞争力分析》报告
2. 《中国农科院农业学科领域竞争力分析》报告
3. 《我国农业学科评价与综

✓ 自然语言处理
✓ 文本挖掘
✓ 知识组织
✓ 机器学习
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方法体系
◇ 文献计量
◇ 统计分析
◇ 引用分析
◇ 主题地图
◇ 专利地图
.....

评价指标体系
◇ 学术质量及影响力
◇ 科研产出能力
◇ 技术宽度
◇ 技术储备
◇ 技术影响力
.....

研究云（国家、机构、团队等）

定性定量计量

科技数据：科技文献、专利文献、网络资源、科研项目、科技奖励、科技成果、科研产品、科技人才等

Agricultural science and technology policy analysis

农业科技前沿与政策咨询决策

Main content

- Agricultural technology frontier and policy information monitoring technology

主要产品

1. 《农业科技前沿与政策咨询快报》——月报



1. Analysis of agricultural international scientific research competitiveness based on paper output

- * Scientific research productivity
 - * Scientific research influence
 - * International cooperation capacity
- 

22 countries

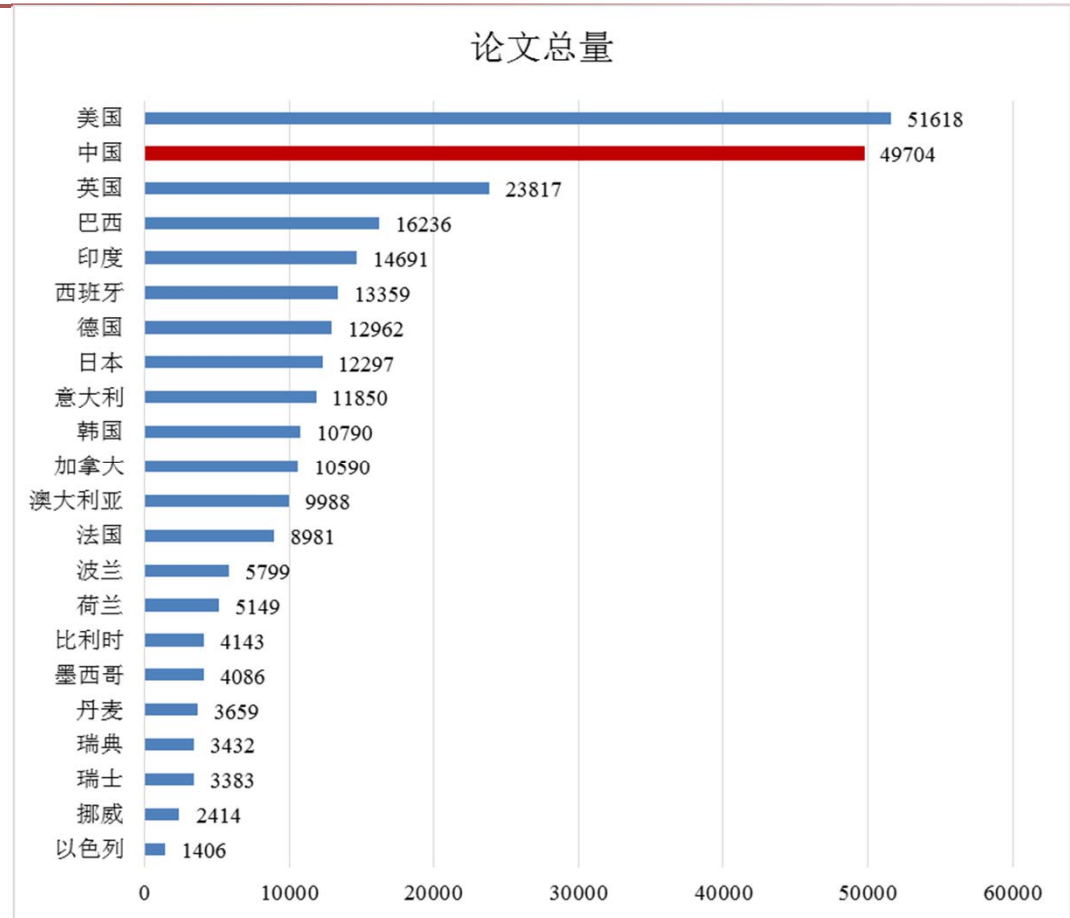
China 、 United States, Germany, India, Britain, Australia, Brazil, Spain, Italy, Japan, France, Korea, Canada, Poland, Holland, Belgium, Mexico, Denmark, Switzerland, Sweden, Norway, Israel.

(1) Scientific research productivity – total amount of paper

- * Using the index of **total amount of the paper** to measure the overall scientific research productivity in agriculture of a country.

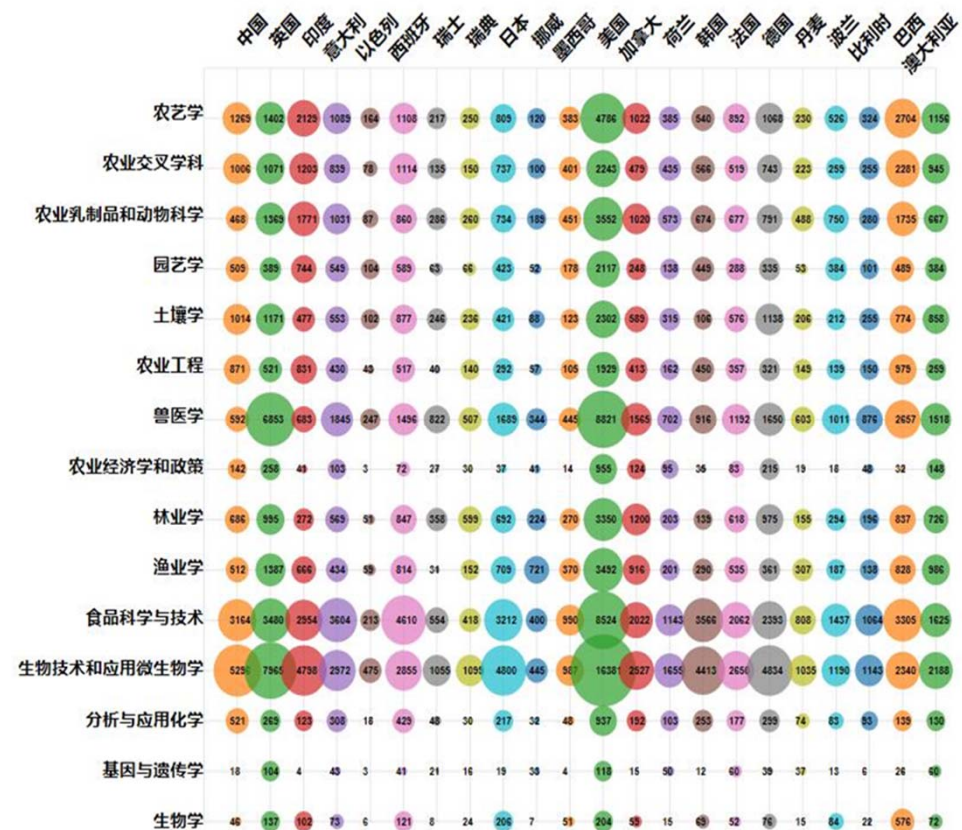
- * The total amount of the paper is defined as the number of papers included by the SCIE for a period of time for a country.

- * In the study period (2014 - 2016), the United States ranked first in the global total amount of papers. **China ranked second**, and the United Kingdom, Brazil and India ranked the third, fourth, fifth separately.



(1) Scientific research productivity – Discipline Distribution of total amount of paper

- * The statistics of the amount of papers in disciplines of various countries in the study period of time, to analyze the global position of the amount of papers in each subject in our country .
- * In terms of the number of papers published, our country's dominant research areas include **agricultural engineering, biotechnology and applied microbiology, analytical and applied chemistry, and agronomy.**

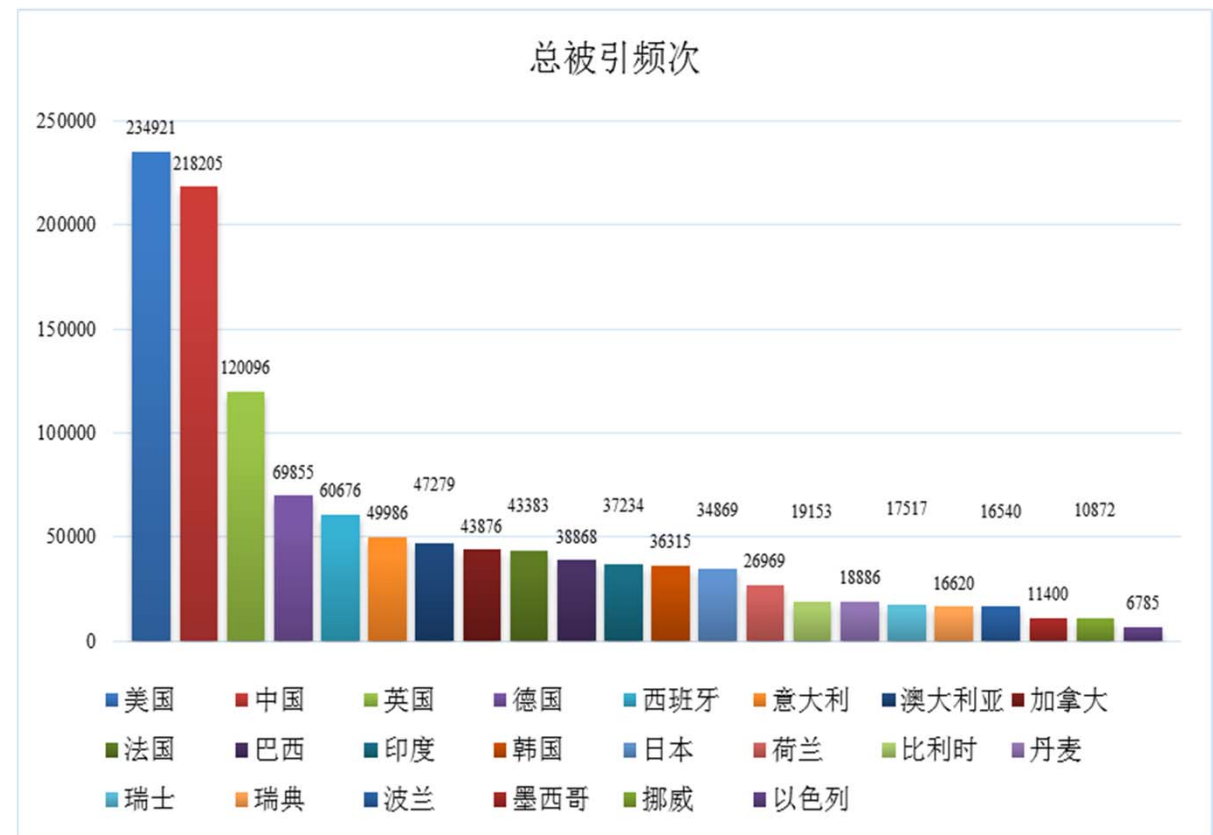


(2) Scientific research influence - the frequency of being cited

- * Using the total cited frequency and influence index of Category Normalized Citation Impact to measure the overall scientific research influence in agriculture of a country.

- * The total citation frequency is the total number of cited times in all the paper records; it refers to the number of cited times by the collection database (SCIE) of the Web of Science™ for a period of time.

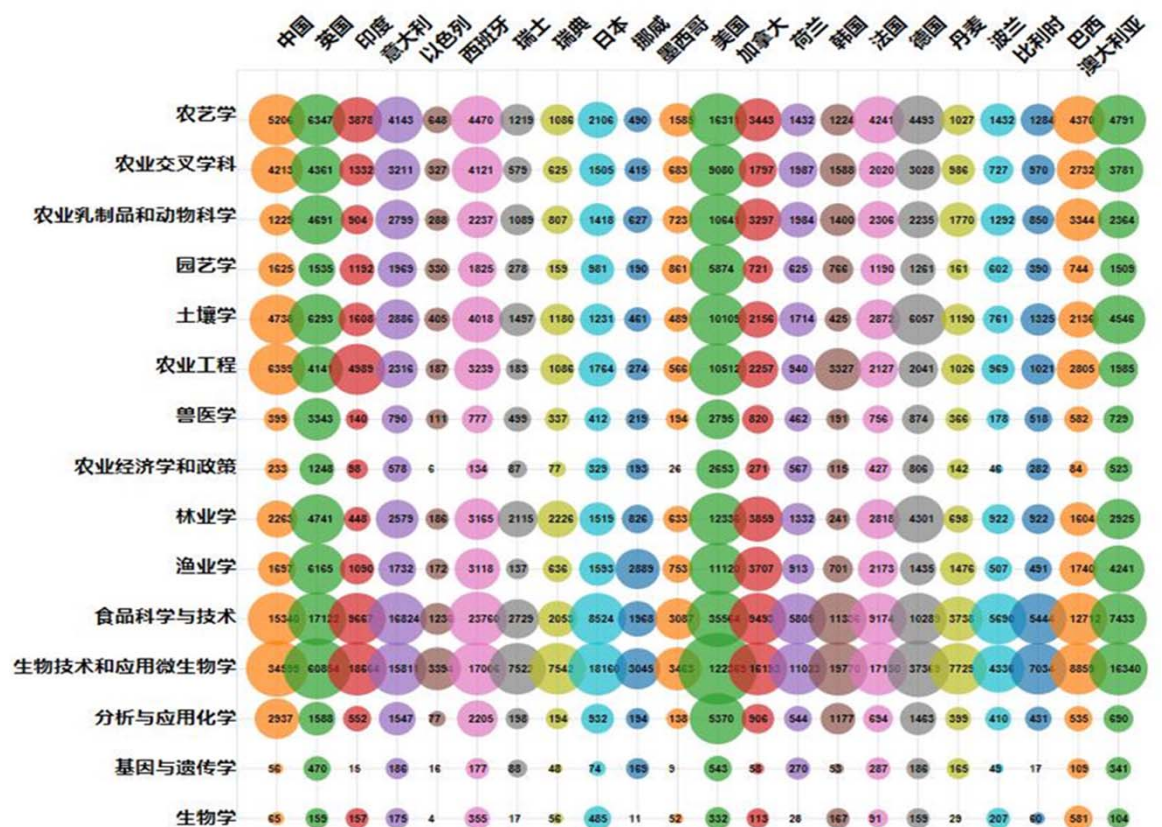
- * the United States took the first place. **China ranked the second.** Britain, Germany and Spain ranked the third to fifth.



(2) Scientific research influence –Discipline Distribution of the cited frequency

* The statistics of the total cited frequency of papers in various disciplines of each country in the study period of time, to evaluate the global position of the total cited frequency of papers in various disciplines of our country.

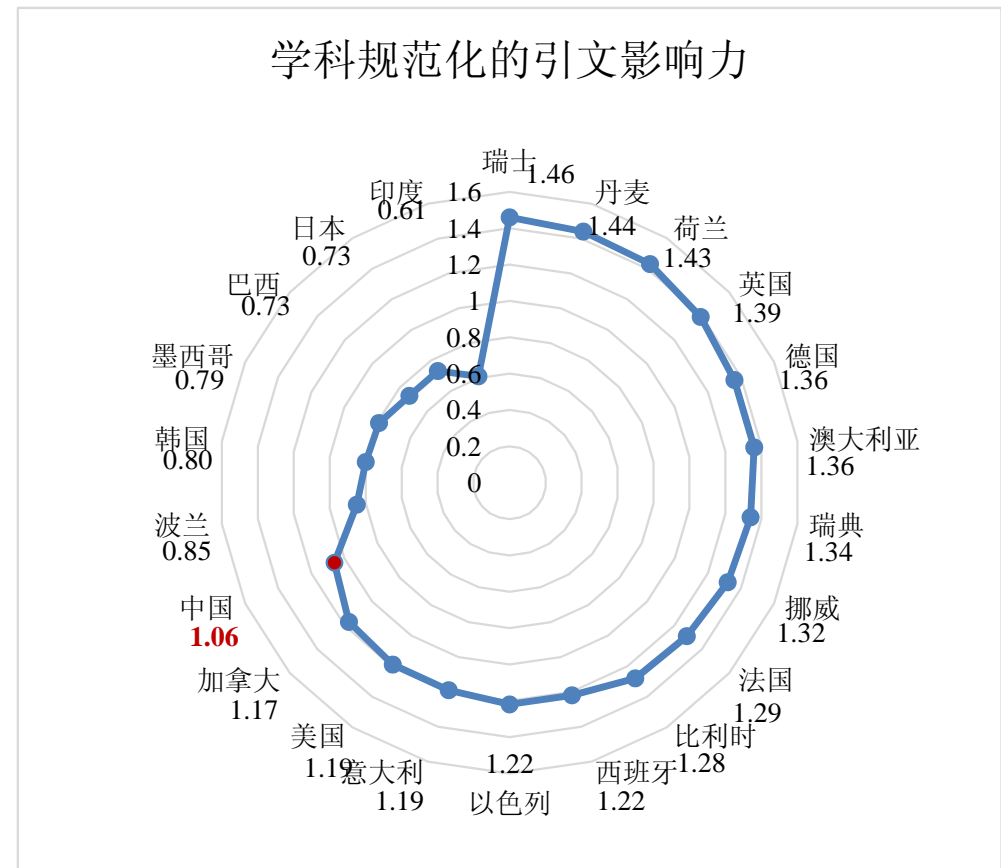
* From the index of total cited frequency, our superior research fields include agronomy, agricultural interdiscipline, analytical and applied chemistry, biotechnology and applied microbiology, food science and technology, and agricultural engineering.



(2) Scientific research influence - Category Normalized Citation Impact

* The citation influence of normalized discipline is the influence of the whole normalized discipline of a group of papers, representing the Category Normalized Citation Impact (CNCI), which is the standardized citation impact based on discipline, publication year and document type.

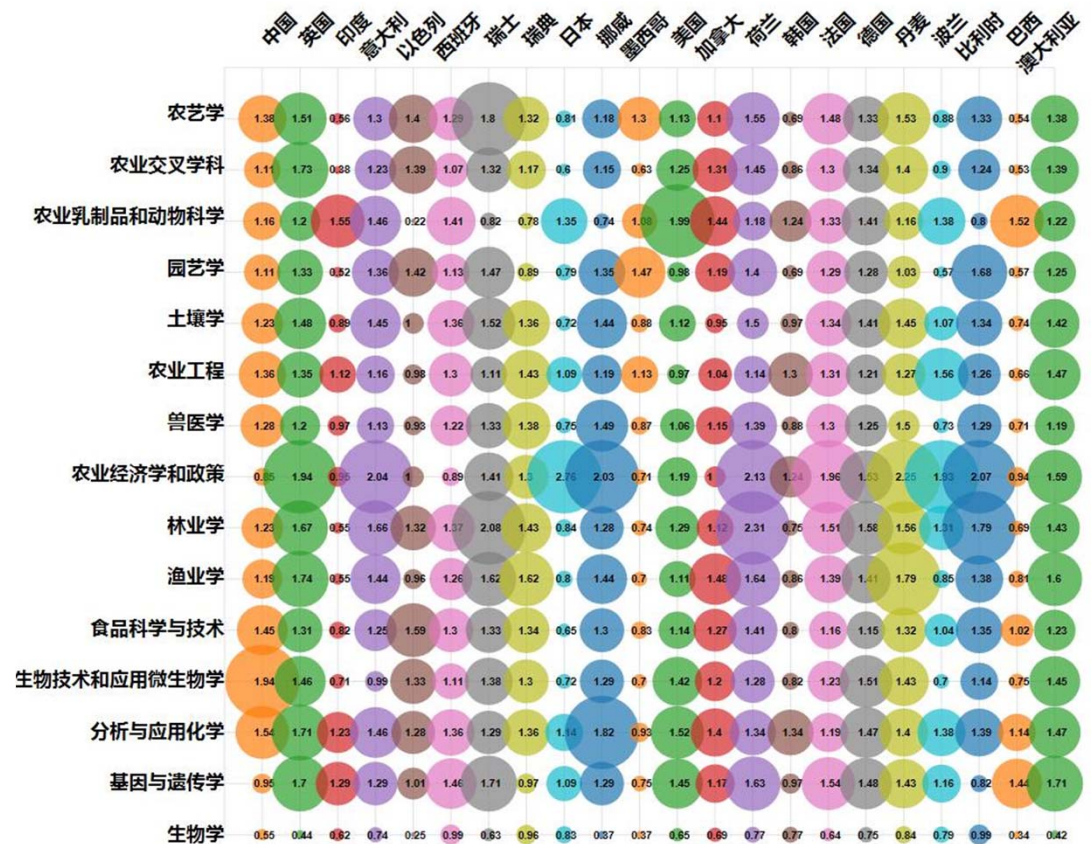
* During the study period, Switzerland ranked the first, Denmark second, Holland the third and China sixteenth.



(2) Scientific research influence – Discipline Distribution of Category Normalized Citation Impact

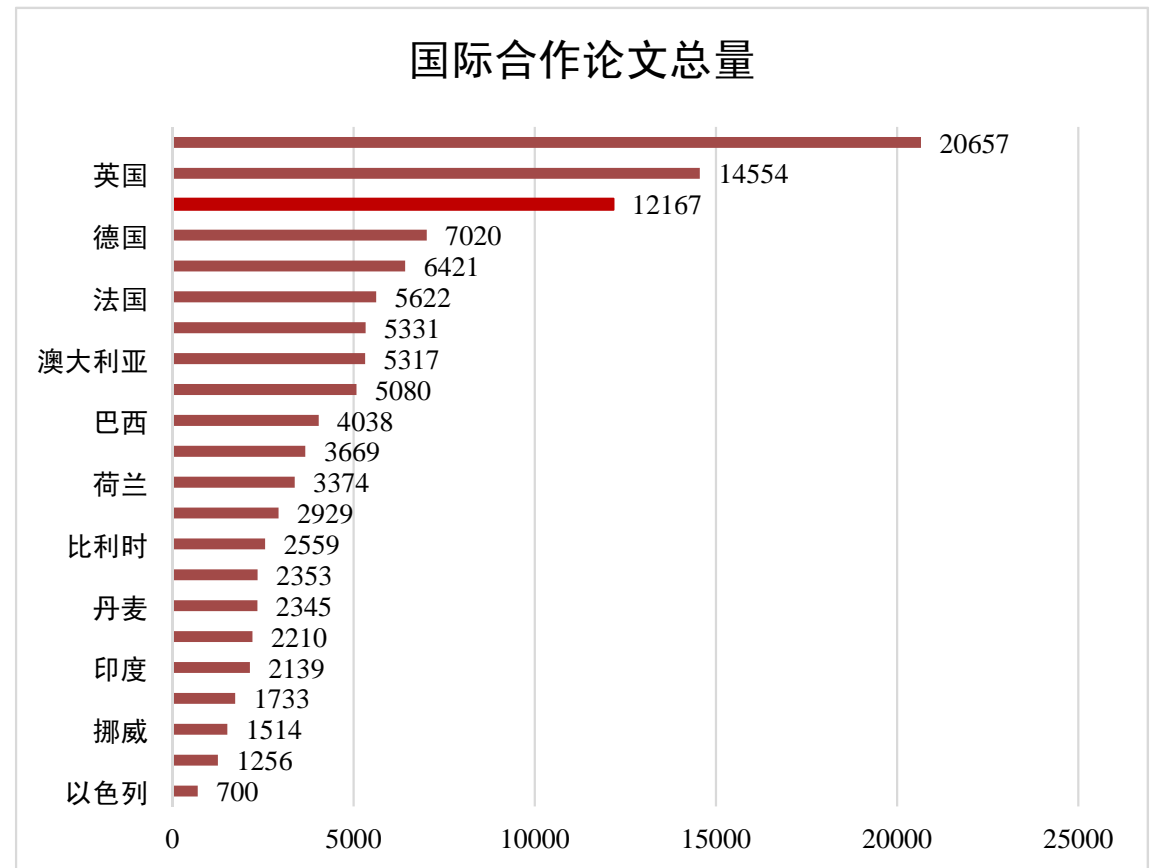
* The statistics of the total cited frequency of papers in various disciplines of each country in the study period of time, to evaluate the global position of the total cited frequency of papers in various disciplines of our country.

* From the index of total cited frequency, our superior research fields include **Biotechnology and applied microbiology, food science and technology, analytical and applied chemistry, and agricultural engineering.**



(3) International Cooperation Capability - the total paper amount of international cooperation

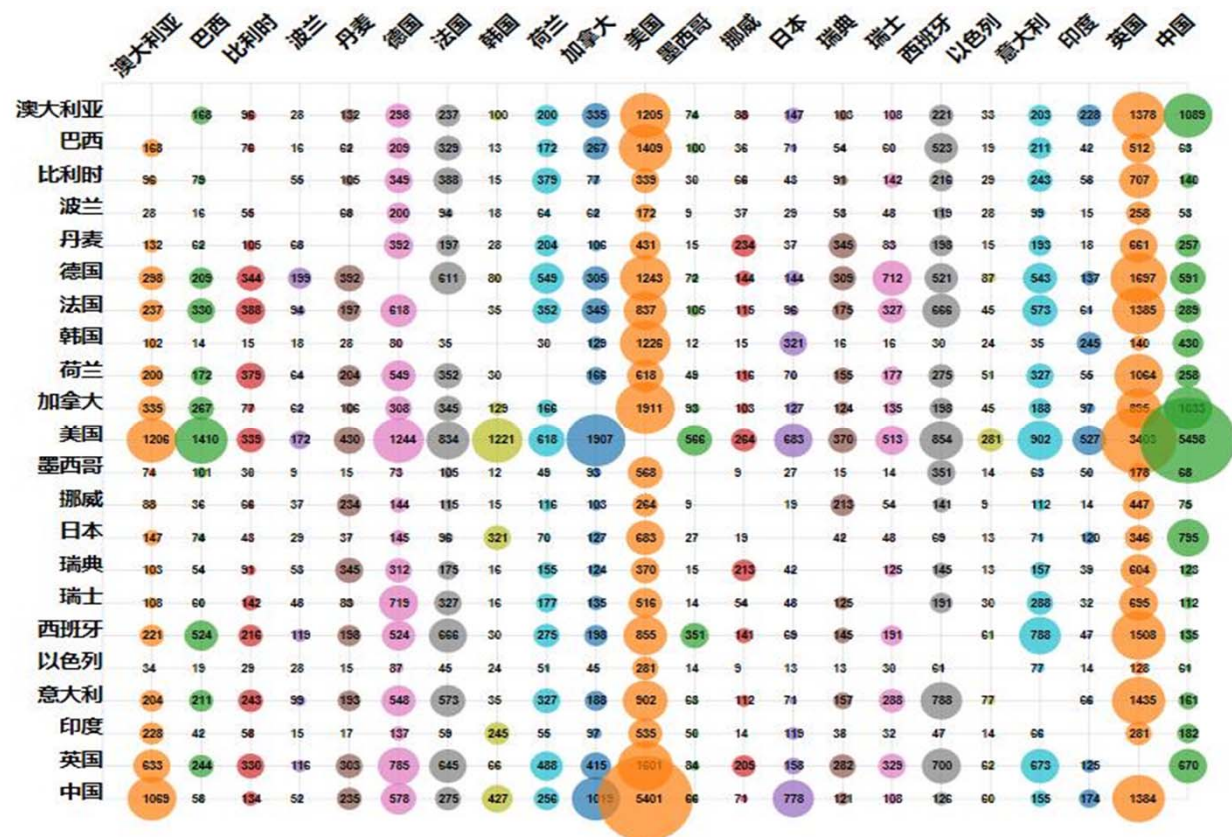
- * Use of the total index of international cooperation papers to measure the international cooperative capacity of the overall scientific research in the country's agricultural field.
- * International cooperation papers refer to papers containing one or more international co authors. The total amount of international cooperation papers reflects the ability of institutions or researchers to attract international cooperation.
- * For the total amount of international cooperation papers, the United States ranked the first, Britain ranked the second, and China was the third. Germany and Spain are the fourth and fifth.



(3) International Cooperation Capability - National distribution of International Cooperation

* Statistics of international cooperation of countries During the study period.

* The most active cooperation partner in agricultural scientific research with our country is the **United States**, Secondly, **Britain**, **Australia**, **Canada**, **Japan** and so on.



2. Evaluation and competitiveness of agricultural disciplines based on paper

- * Scientific research productivity
 - * Scientific research influence
 - * International cooperation capacity
 - * Subject representative unit
- 

1. 农艺学 (Agronomy)
2. 农业交叉学科 (Agriculture, Multidisciplinary)
3. 农业乳制品和动物科学 (Agriculture, Dairy & Animal Science)
4. 园艺学 (Horticulture)
5. 土壤学 (Soil Science)
6. 农业工程 (Agricultural Engineering)
7. 兽医学 (Veterinary Sciences)
8. 农业经济学和政策 (Agricultural Economics & Policy)
9. 林业学 (Forestry)
10. 渔业学 (Fisheries)
11. 食品科学与技术 (Food Science & Technology)
12. 生物技术和应用微生物学 (Biotechnology & Applied Microbiology)
13. 分析与应用化学 (Chemistry, Analytical & Chemistry, Applied)
14. 基因与遗传学 (Genetics & Heredity)
15. 生物学 (Biology)

Taking agronomy as an example

* Scientific research productivity

China's total paper amount is 4093, ranking the **second**;

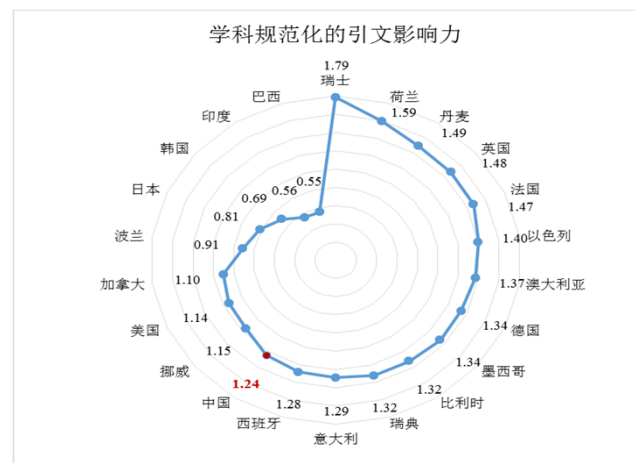
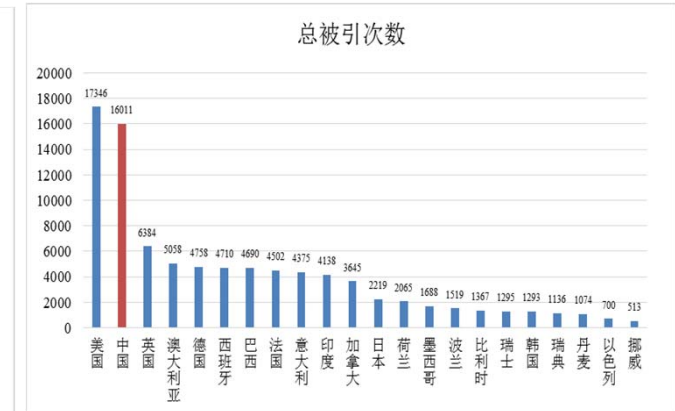
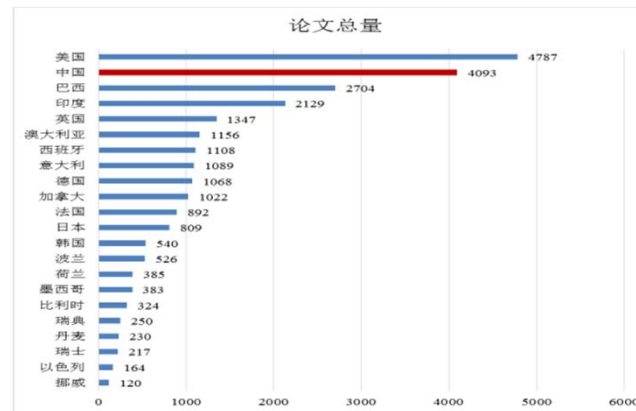
* Scientific research influence

The total cited frequency is 16011, ranking the **second**.

The citation influence of normalized discipline is 1.24, and the ranking is the **fourteenth**.

* International cooperation capacity

The total number of papers in international cooperation is 1374, ranking the **second**.

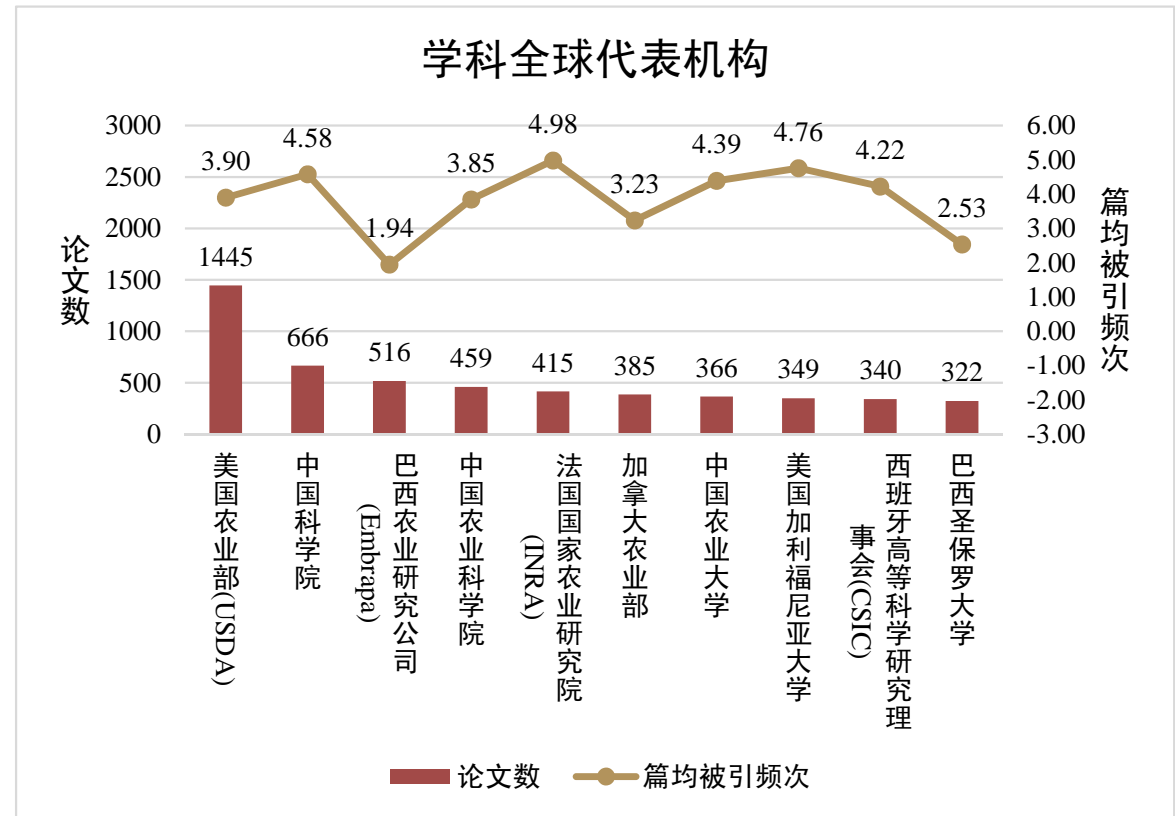


Taking agronomy as an example

- * A global representative institutions of the subject

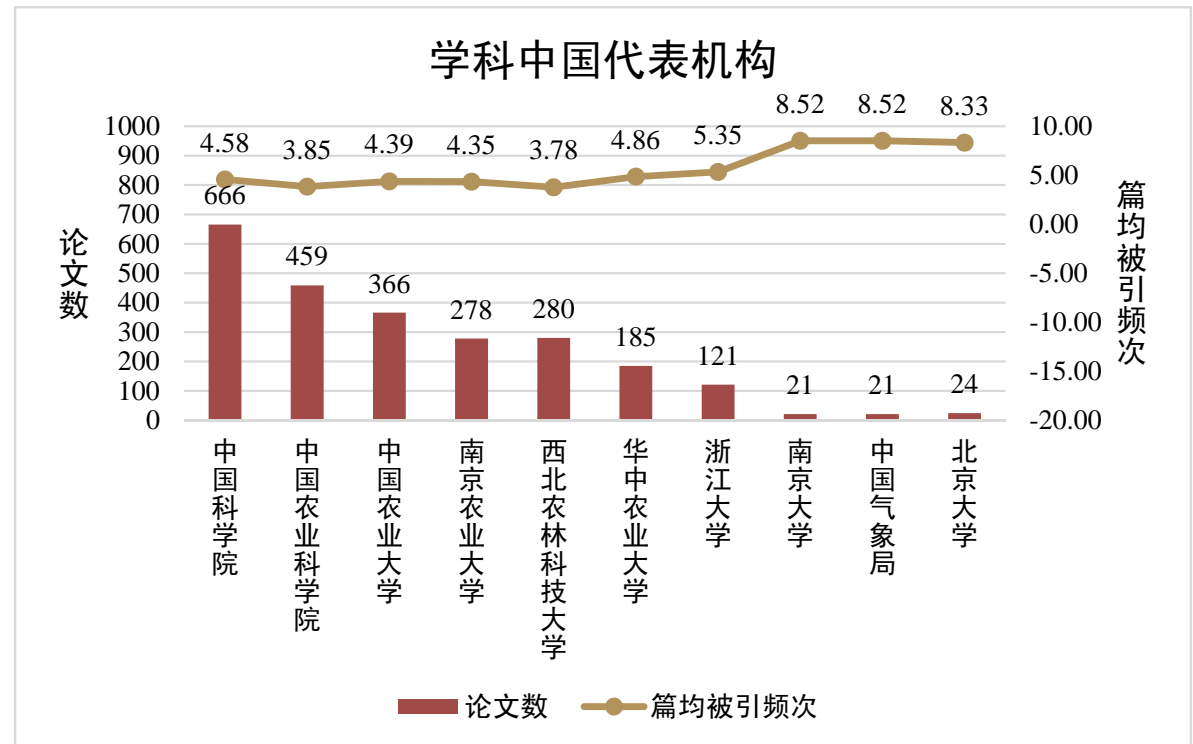
$$\text{综合指标} = \frac{\text{当前机构论文数}}{\text{最大机构论文数}} * 0.5 + \frac{\text{当前机构篇均被引频次}}{\text{最大机构篇均被引频次}} * 0.5 \quad (\text{公式1})$$

- * The first ten institutions are the United States Department of agriculture (USDA), the Chinese Academy of Sciences, Brazil Agricultural Research Corporation (Embrapa), Chinese Academy of Agricultural Sciences, French National Agricultural Research Institute (INRA), Canada Agriculture Department, China Agricultural University, University of California, Spain's higher scientific research council (CSIC), Brazil University of Sao Paulo.



Taking agronomy as an example

- * National representative agency of the subject
- * The Chinese Academy of Sciences, the Chinese Academy of Agricultural Sciences, the China Agricultural University, Nanjing Agricultural University, Northwest Agriculture and Forestry University, Huazhong Agricultural University, Zhejiang University, Nanjing University, China Meteorological Administration and Beijing University.



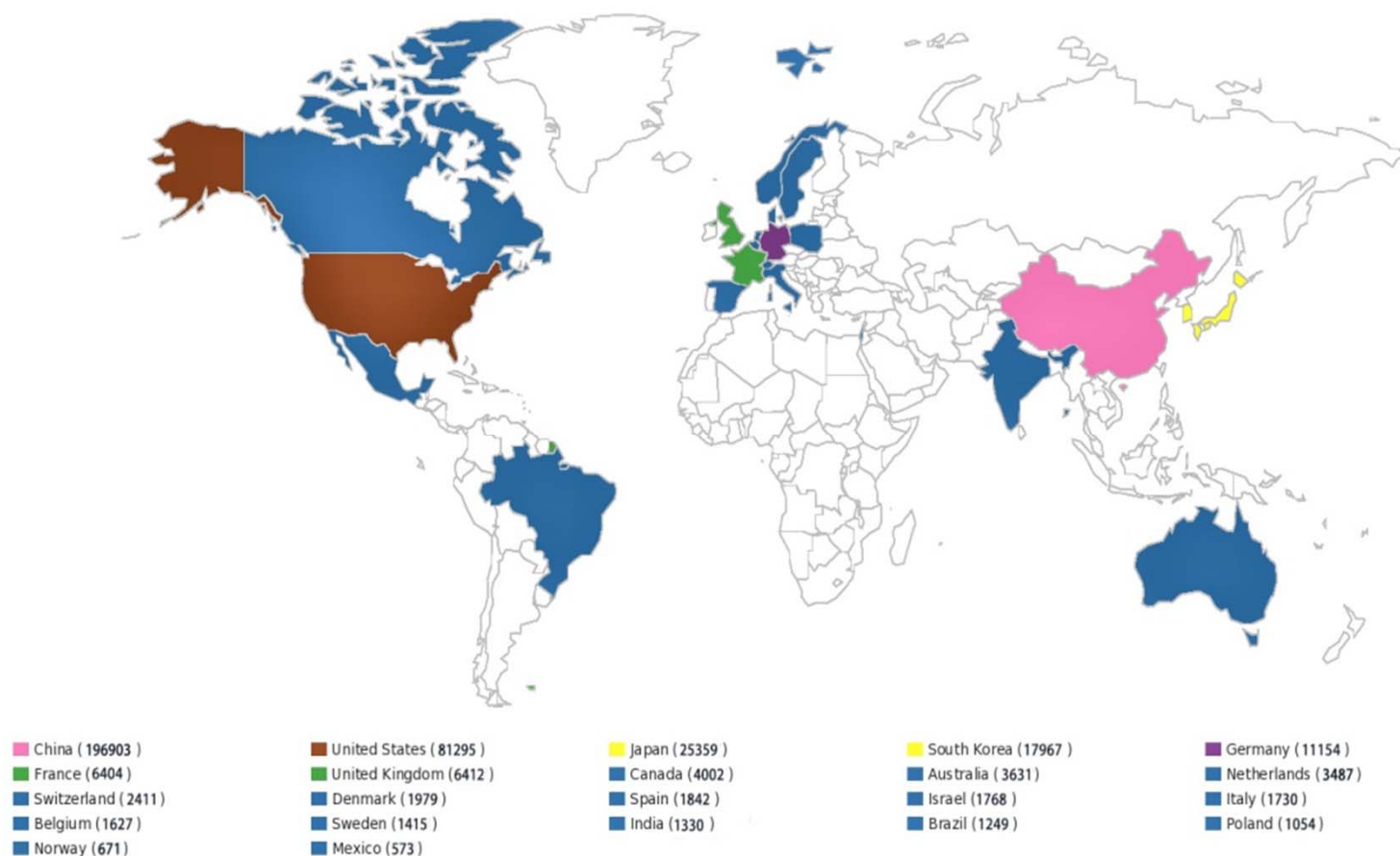
3. Analysis and evaluation of agricultural scientific research competitiveness based on Patent Output

- (1) Application amount of patent for invention
- (2) Patent authorization rate for inventions
- (3) Global important patent holder
- (4) Global layout of patents
- (5) Patented family size
- (6) Patented technology width
- (7) High strength patent

(1) Application amount of patent for invention

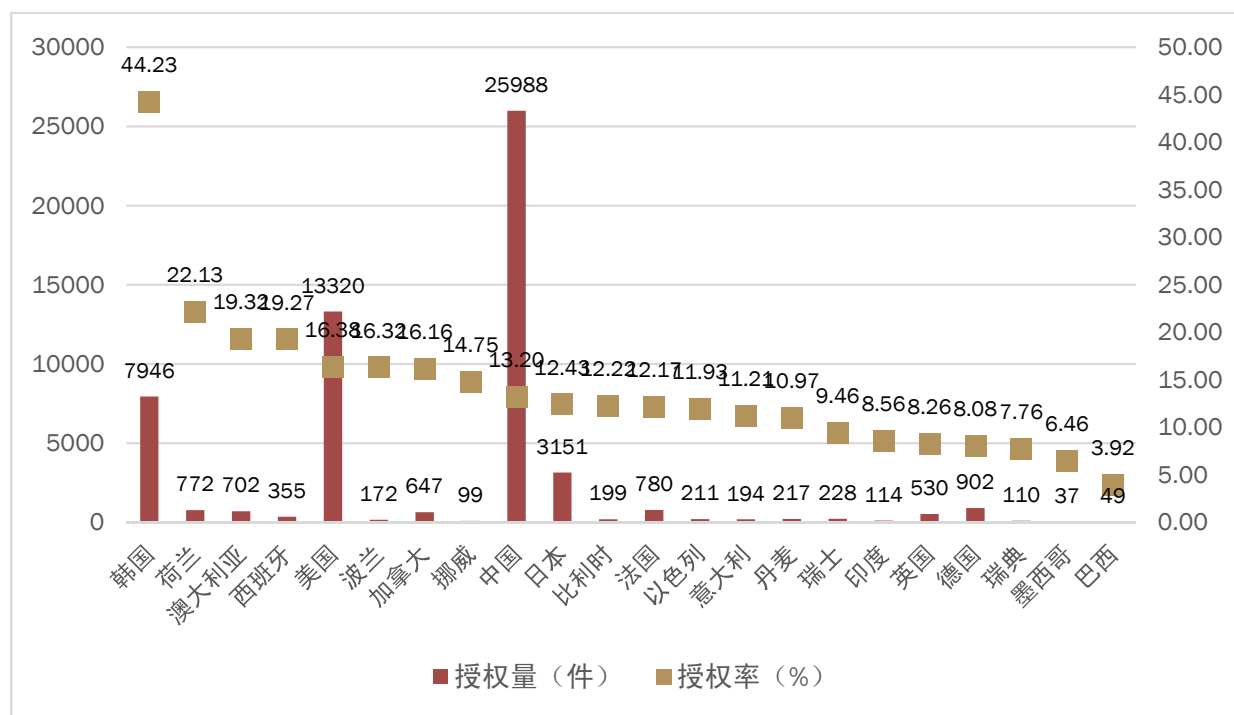
* In the years of 2014-2016, **China topped the list by 196903 in patent application**, accounting for 52.61% of the total application of 22 countries (374263).

The United States 81295 ranked second. Japan, South Korea and Germany are third, fourth, fifth.



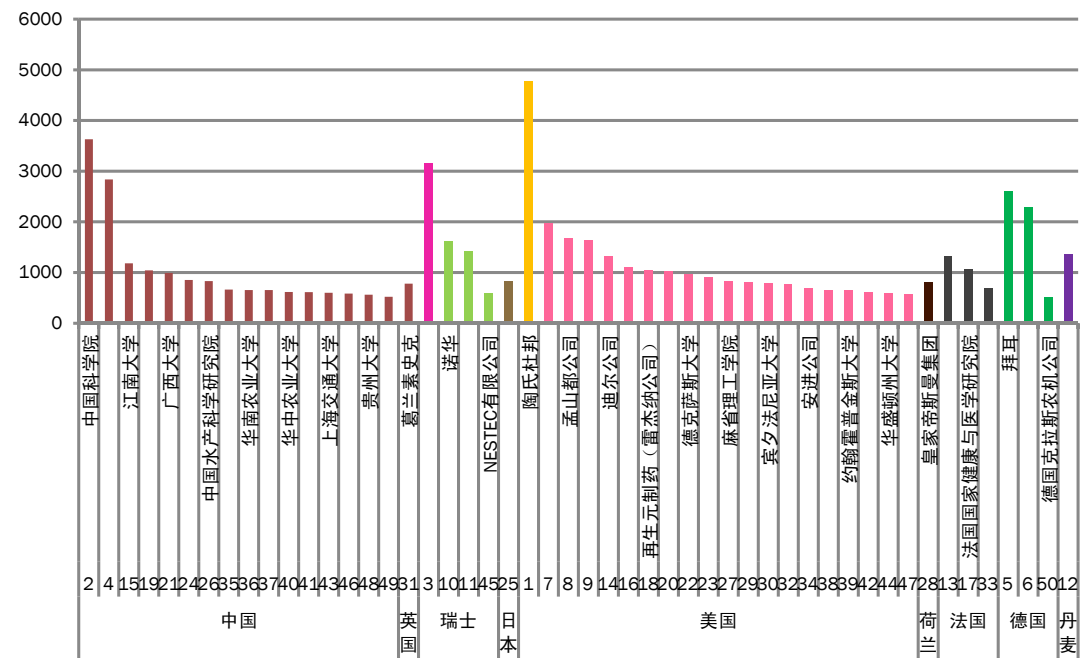
(2) Patent authorization rate for inventions

- * The authorization rate of the invention can reflect the relative quality of the patent.
- * Korean authorization rate of the invention patent reached 44.23%, followed by Holland, Australia and Spain.
- * The US patent authorization rate is 16.38%, which is the fifth.
- * China is only 13.2%, and the ranking of the 22 countries is the ninth.



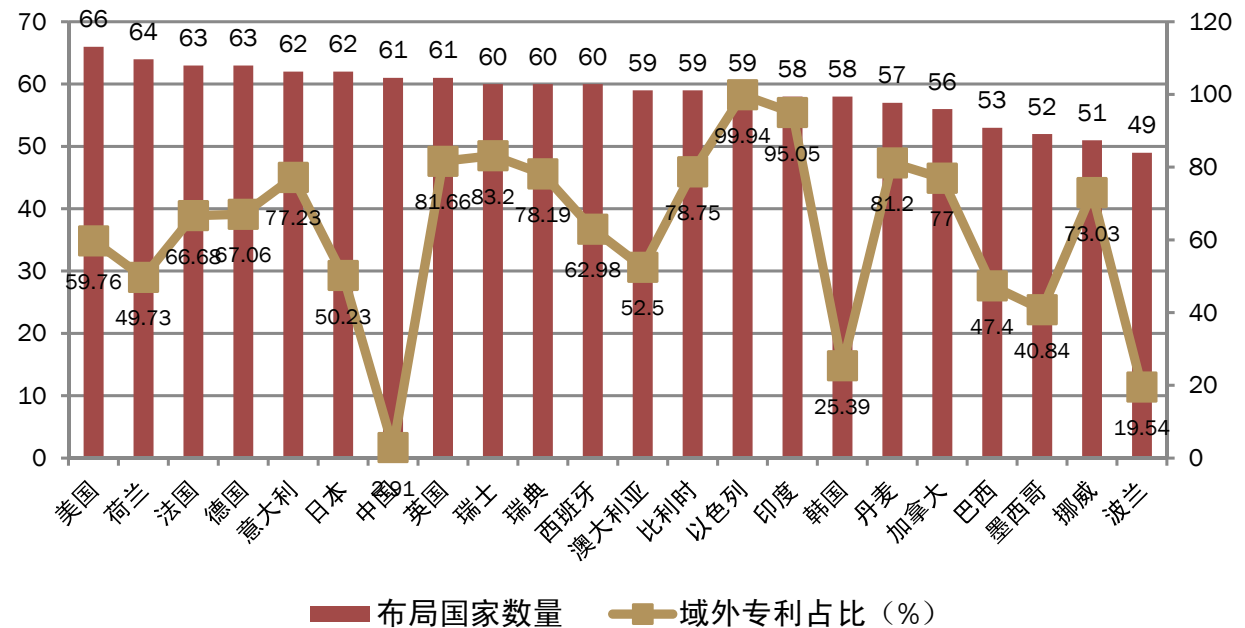
(3) Global important patent holder

- * The state situation that the world's important patent holders belong to can reflect the strength of the R & D team of various countries.
- * The top ten institutions include 4 in the US (DuPont global first), 2 in the Switzerland (Roche ranking second), 2 in Germany (the third & fifth), 2 in China, the Chinese Academy of Sciences and Chinese Academy of Agricultural Sciences ranked second and fourth respectively.



(4) Global distribution of patents - the number of layout countries and the ratio of Extraterritorial Application

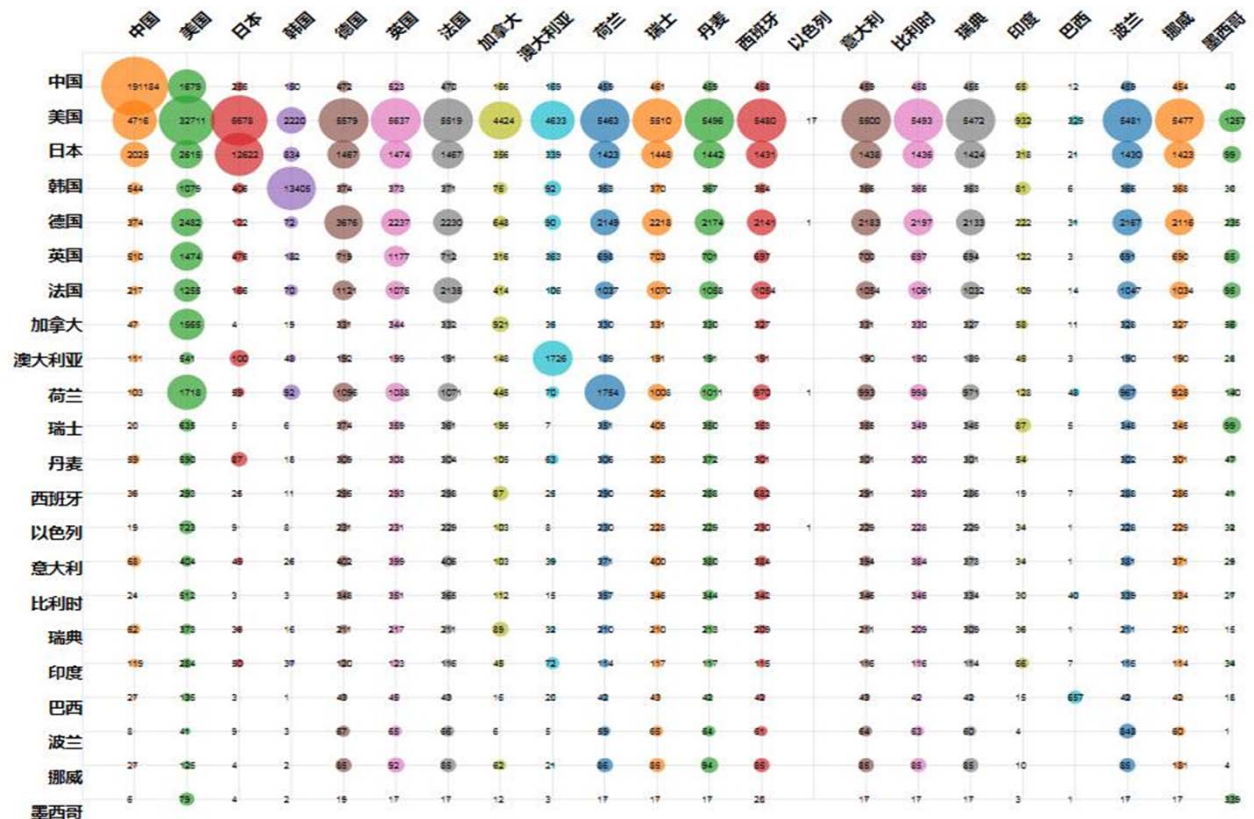
- * The layout of the patent can be used to illustrate the scope of the technology export.
- * The US, Holland, France, Germany, Italy and Japan ranked the top in 22 countries in terms of technology export. Besides Holland, their overseas applications were basically above 50%.
- * China has submitted the technology patent application to 61 countries, ranking the seventh, but the extraterritorial application is only 2.91%, ranking at the last place.



(4) Global layout of patents – patents quantity

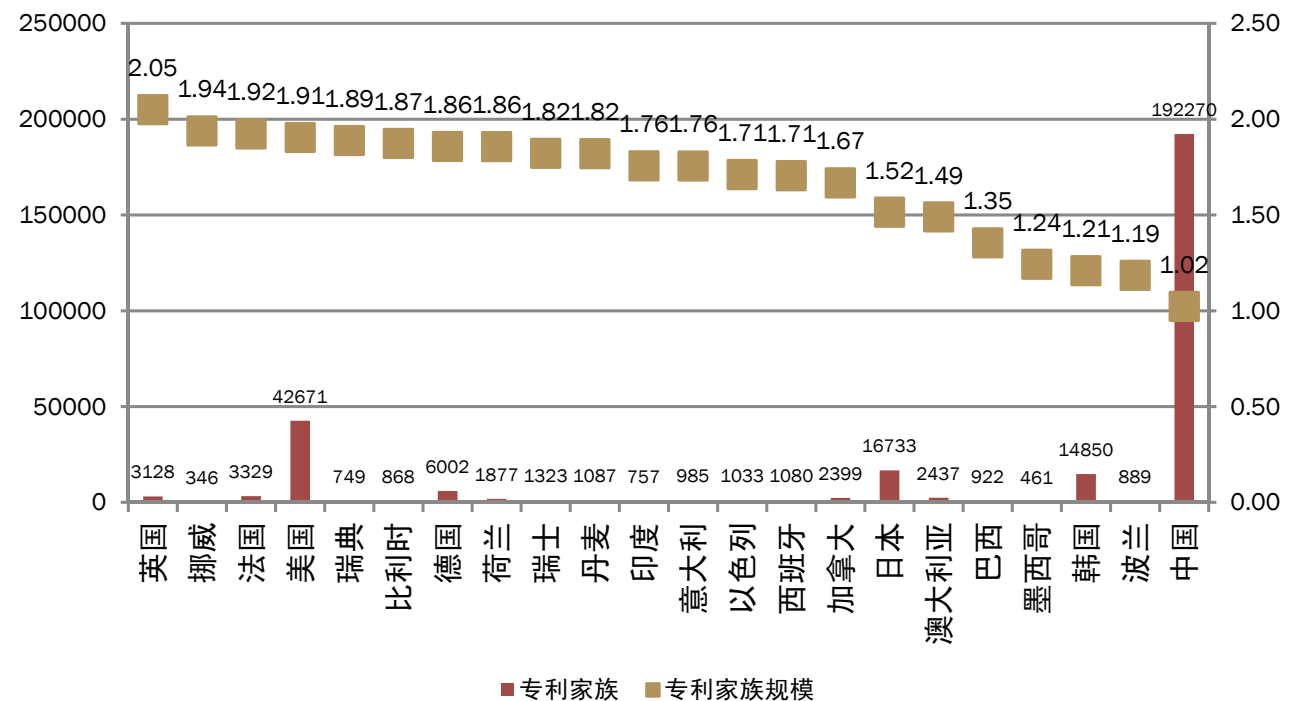
* The United States, Germany, Holland and Israel have patent applications in other 21 countries.

* China has applied mainly in the country, the United States is China's largest target countries except for its native land, followed by Britain, Germany and France.



(5) Patented family size

- * The patent family size shows the importance of technology.
- * Britain, Norway, France, the United States and Sweden have a relatively high ranking of patent families.
- * China has a large number of patent applications and a large number of patent families, but most of them are single piece patents. The average size of the patent family is only 1.02, ranking the last in the 22 countries.

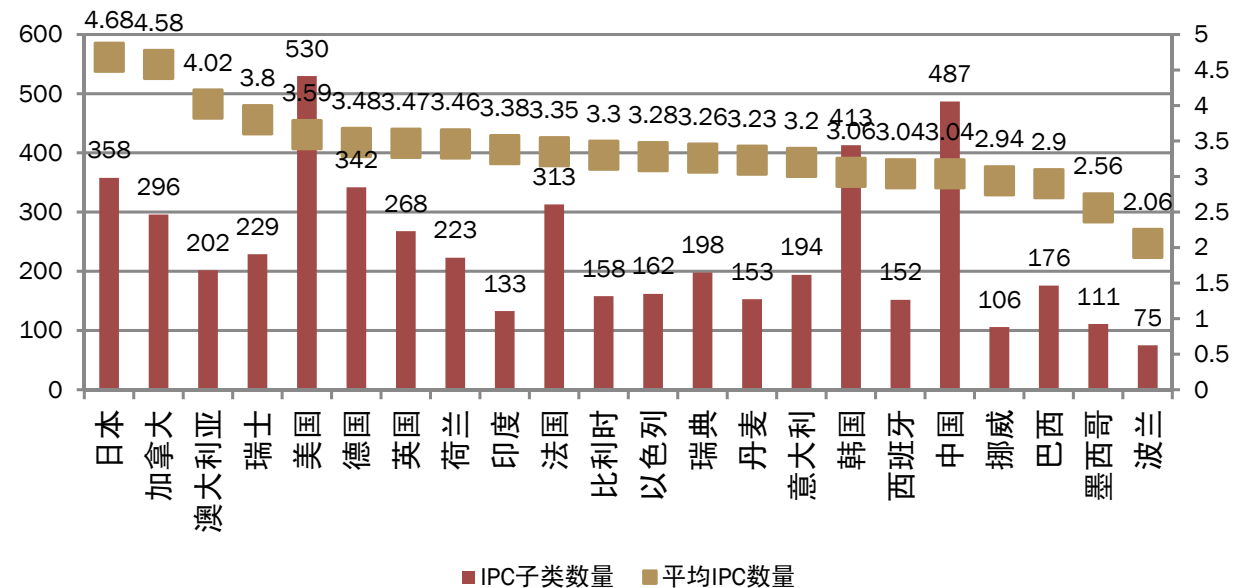


(6) Patented technology width

* To a certain extent, IPC represents the technical direction of patent protection, and analyzes the technical width by calculating the average number of IPC for each country's invention patents.

* Japan, Canada Australia, Switzerland, and the United States are the top five.

* China ranked 17 in the 22 countries.



(7) High strength patent

- * The patent strength can comprehensively reflect the value of the patent.
- * Patent strength greater than 5 in countries, this patent volume ratio is all below 10% , of which the **United States** is the highest, accounting for 9.18%.
- * The US has an overall outstanding performance, and the technological influence is far ahead.
- * Although the total number of **Israel** patent applications is behind the rankings, it has 7.60% of high strength patents, which account for second. **China** only has 2.48% patent strength which is over 5, and the ranking is relatively backward among the 22 countries.

国家	专利强度占比 (%)					
	0-5	>5	>6	>7	>8	9-10
美国	90.82	9.18	6.07	3.20	1.63	0.60
中国	97.52	2.48	1.67	0.20	0.01	0.00
德国	95.99	4.01	2.59	1.32	0.41	0.20
印度	98.09	1.91	1.27	0.64	0.07	0.00
英国	95.46	4.54	2.96	1.51	0.70	0.13
澳大利亚	97.47	2.53	1.68	0.94	0.42	0.07
巴西	98.99	1.01	0.46	0.15	0.00	0.00
意大利	96.55	3.45	2.39	1.43	0.85	0.11
西班牙	98.62	1.38	0.55	0.23	0.05	0.00
法国	97.96	2.04	1.30	0.54	0.24	0.04
加拿大	93.56	6.44	4.27	2.30	1.00	0.29
荷兰	94.49	5.51	3.45	1.81	0.93	0.23
日本	98.34	1.66	1.04	0.46	0.12	0.04
瑞士	95.28	4.72	3.37	1.35	0.89	0.19
瑞典	97.00	3.00	1.73	0.73	0.27	0.00
波兰	99.84	0.16	0.08	0.08	0.08	0.08
比利时	94.80	5.20	3.41	2.01	0.89	0.34
丹麦	94.55	5.45	2.91	1.43	0.32	0.00
韩国	99.38	0.62	0.34	0.17	0.04	0.01
挪威	98.35	1.65	0.96	0.41	0.28	0.00
以色列	92.40	7.60	5.07	2.17	1.24	0.26
墨西哥	98.98	1.02	0.85	0.85	0.17	0.00

Thanks for your attention !

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