

中国生物育种技术专利状况

Patent Status of Biological Breeding Technology in China

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中国高度重视生物育种技术和相关的知识产权问题

China attaches great importance to the bio-breeding industry and related intellectual property issues



中共中央总书记、国家主席、中央军委主席习近平在位于三亚市崖州湾科技城的崖州湾种子实验室考察

- Chinese President Xi Jinping, also general secretary of the Communist Party of China Central Committee and chairman of the Central Military Commission, visits a seed laboratory to learn about seed industry innovation in Sanya, South China's Hainan province, April 10, 2022.

要围绕保障粮食安全和重要农产品供给集中攻关，实现种业科技自立自强、种源自主可控，用中国种子保障中国粮食安全。中国人的饭碗要牢牢端在自己手中，就必须把种子牢牢攥在自己手里。

China's food security can only be achieved when seed resources are tightly held in Chinese hands, Xi said, adding that the country's seed sources must be independent and controllable, and technologies related to the seed industry must be self-reliant.

- 习近平总书记在2021年7月9日主持召开中央全面深化改革委员会第二十次会议，审议通过《种业振兴行动方案》提出，要启动种源关键核心技术攻关，实施生物育种重大项目，持续推进南繁等育种制种基地建设，扎实推进知识产权保护，实现种业科技自立自强、种源自主可控。
- General Secretary Xi Jinping chaired the 20th meeting of the Central Committee for Comprehensively Deepening Reform on July 9, 2021, and considered and adopted "Seed Industry Revitalization Action Plan", proposing to launch research on key core technologies for seed sources, implement major projects for biological breeding, continuously promote the construction of breeding and seed production bases such as Southern Propagation, and solidly promote the protection of intellectual property rights, so as to achieve self-sustainability and self-improvement in seed technology and independent control of seed sources.
- 《知识产权强国建设纲要（2021-2035年）》中也提出要“围绕生物育种前沿技术和重点领域，加快培育一批具有知识产权的优良植物新品种，提高授权品种质量”。
- The Outline for Building a Strong Intellectual Property State (2021-2035) also proposes to "accelerate the breeding of a number of new excellent plant varieties with intellectual property rights around the frontier technology and key areas of biological breeding, and improve the quality of authorized varieties".

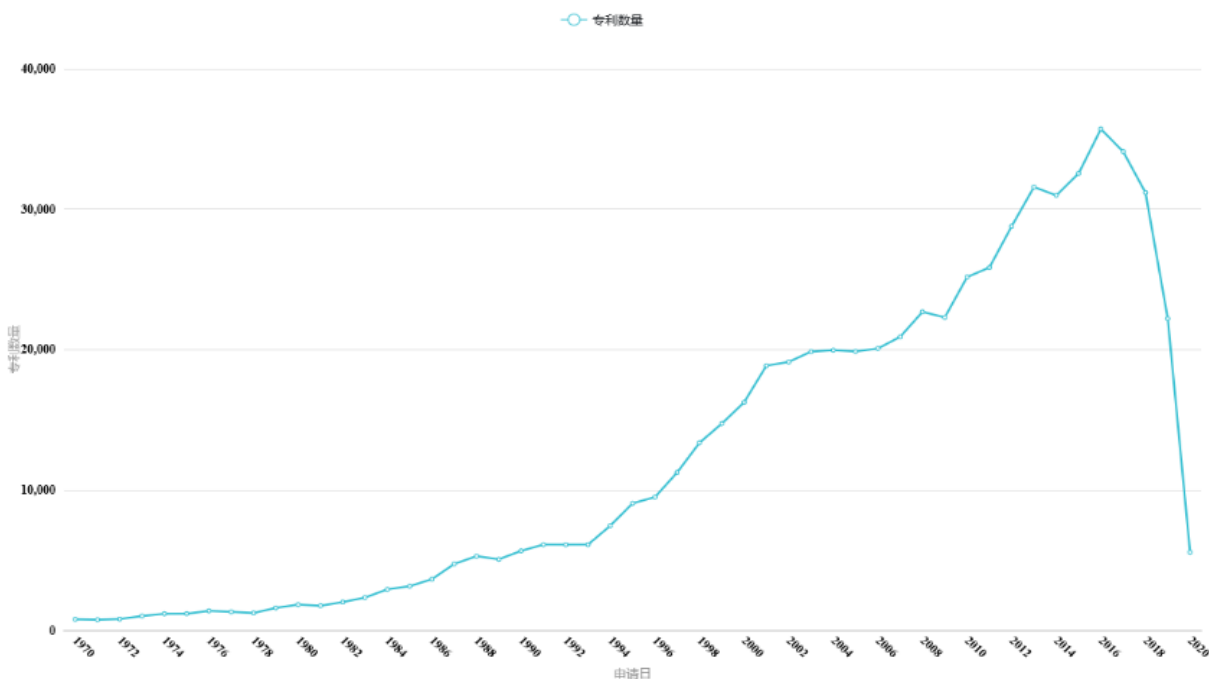
使用中英文超过8000个关键词和专利分类号的专利检索式，对生物育种中分子标记育种、转基因育种和基因编辑育种等领域，**世界范围专利申请66.2万项，其中中国专利申请17.2万件**进行了大数据的专利分析（专利的样本来自Incopat数据库。检索截止日期为2020年10月20日）

A patent search formula with over 8,000 keywords and patent classification numbers in English and Chinese was used to search patents in the fields of molecular marker breeding, transgenic breeding and gene editing breeding in biological breeding. **Patent analysis of big data** was conducted **on 662,000 worldwide patent applications**, including **172,000 Chinese patent applications**.

- 部分检索式（part of the patent search query）：
- (标记 OR (标记 2n 辅助) OR marker* OR (marker* 2n assist*) OR (molecular 2n marker*) OR RFLP OR RAPD OR AFLP OR SCAR OR CAPS OR SSR OR ISSR OR RAMP OR REMAP OR RMAPD OR SNP) AND (植物 OR plant\$ OR 棉 OR COTTON OR 亚麻 OR Flax OR (Linum n usitatissimum) OR GOSSYPIUM OR 油菜 OR 豆 OR SOYBEAN OR (GLYCINE n MAX) OR 葵花籽 OR sunflow* OR 甜菜 OR (Sugar n Beet) OR 甘蔗 OR (Sugar n cane) OR sugarcane OR Saccharum OR (Capsicum n annuum) OR 稻 OR Rice OR (Oryza n sativa) OR (Beta n vulgaris) OR 玉米 OR maize OR corn\$ OR (Zea n mays) OR 高粱 OR broomcorn* OR 番茄 OR 西红柿 OR Tomato* OR (Lycopersicon n esculentum) OR 麦 OR Wheat OR (Triticum n aestivum) OR 南瓜 OR Squash OR (Cucurbita n pepo) OR 甜椒 OR pimento OR (Capsicum 2n annuum) OR 马铃薯 OR 土豆 OR Potato* OR 豇豆 OR Cowpea OR (Vigna n unguiculata) OR 茄子 OR Eggplant\$ OR (Solanum n melongena) OR 苜蓿 OR Alfalfa OR (Medicago n sativa) OR 紫云英 OR (milk 2n vetch)OR (astragalus 2n smicus) OR 苹果 OR Apple\$ OR (Malus 2n Domestica) OR 木瓜 OR Papaya OR (Carica n papaya) OR (Solanum n tuberosum) OR 烟草 OR Tobacco OR (Nicotiana n tabacum) OR 甜瓜 OR Melon OR (Cucumis n melo) OR 白菜 OR 波兰油菜 OR (Polish n canola) OR (Brassica n rapa) OR 康乃馨 OR 石竹 OR Carnation OR (Dianthus caryophyllus) OR 菊苣 OR Chicory OR (Cichorium intybus) OR 杨树 OR Poplar OR Populus OR 桉树 OR Eucalyptus OR 牵牛 OR 碧冬茄 OR 矮喇叭 OR 番薯花 OR 隼子花 OR 撞羽朝颜 OR Petunia) AND (IPC=(C12N* OR C07K* OR C12Q* OR G01N* OR A01H*))-- (Patent search from Incopat database. Search date is 20 October 2020)

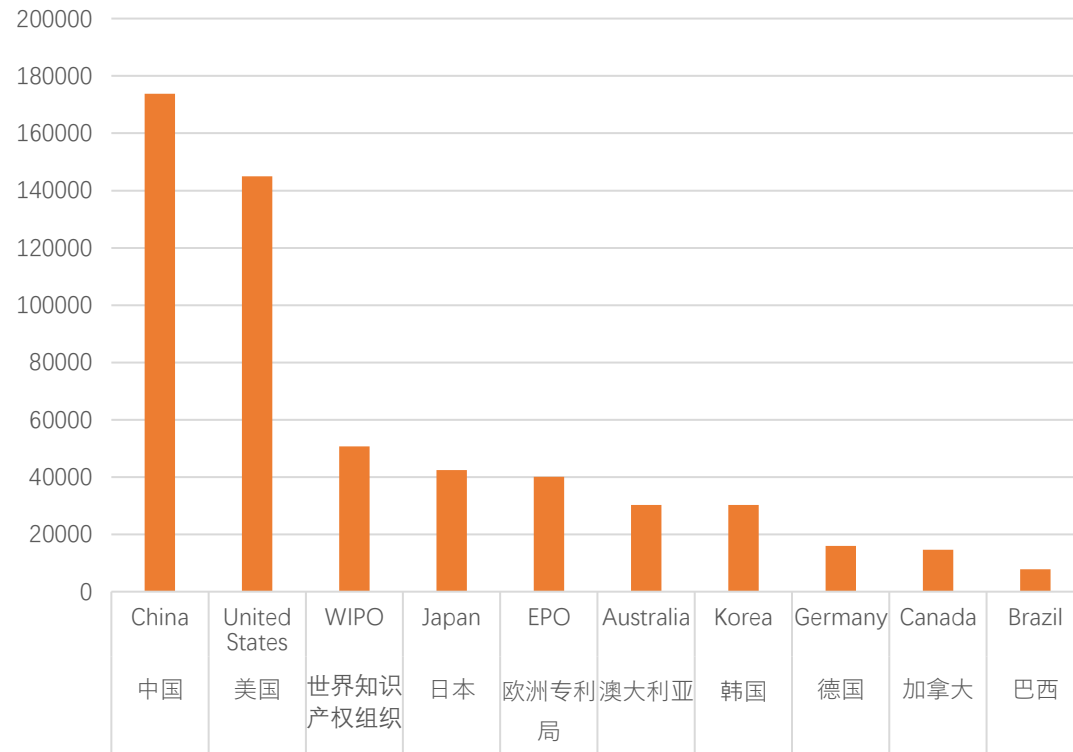
当前全球生物育种专利申请量呈上升态势，尤其近十年来进入快速发展阶段。中国和美国是主要专利申请国。三大种业巨头陶氏杜邦、孟山都和先正达在专利申请量上优势明显。

The number of biobreeding patent applications worldwide is currently on the rise, especially in the last decade, and has entered a phase of rapid development. China and the US are the main patent filing countries. The three seed giants, DowDuPont, Monsanto and Syngenta, have a clear advantage in terms of patent filings.



生物育种世界范围专利申请趋势变化情况

Worldwide Patenting Trends in Biological Breeding Technology

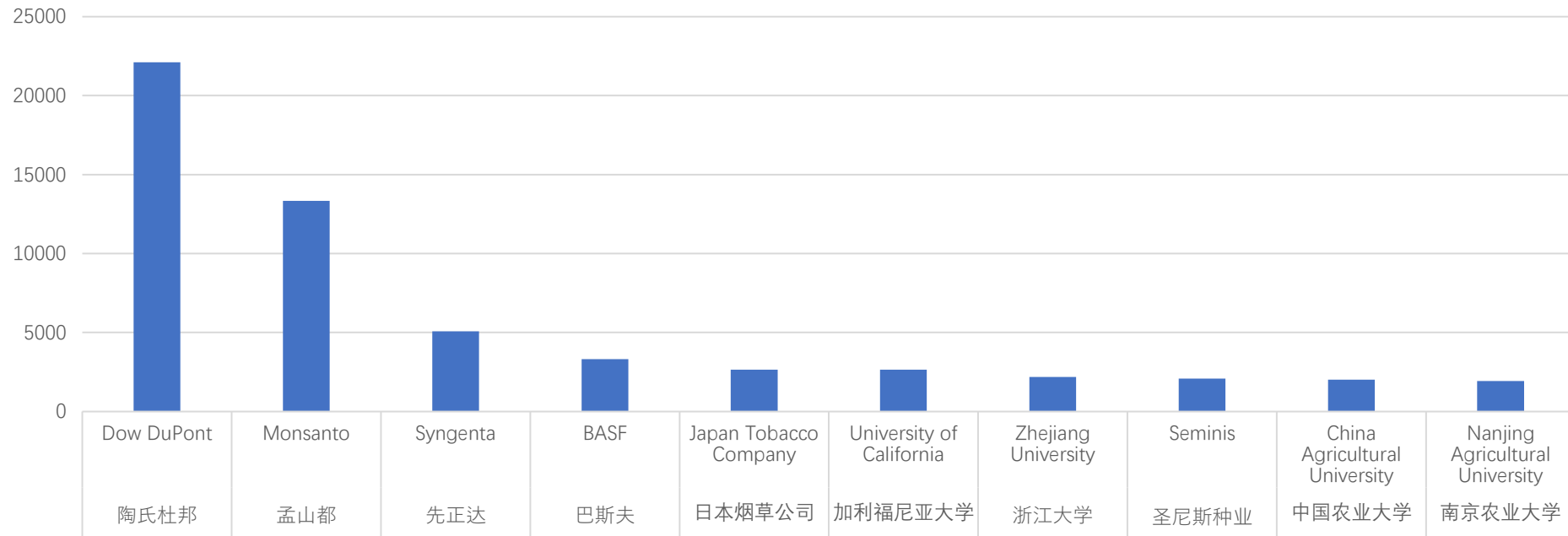


生物育种专利申请国家分布情况

Country Distribution of Biological Breeding Patent Applications

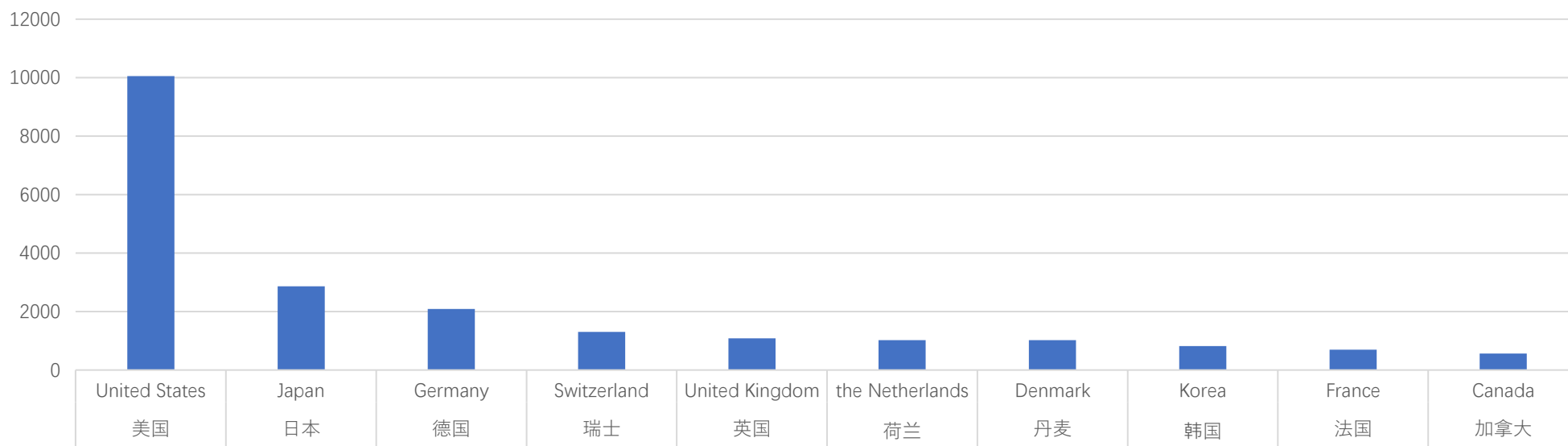
- 在排名前10的专利权人中，有6家是跨国企业，4个是研究机构或高校。其中，世界三大种业巨头陶氏杜邦、孟山都、先正达在申请量上优势明显。我国在该领域专利数量上位居前列的机构均是高校，包括浙江大学、中国农业大学和南京农业大学。在专利战略布局方面，国外机构高度重视全球专利布局，而中国的申请人96.61%只在国内申请了专利，对于国外市场的专利布局较弱

- Patent application and relevant research relating to biological breeding is even more energetic in China, adding that many Chinese applicants are those from academic institutions and universities, such as Zhejiang University, China Agricultural University and Nanjing Agricultural University.
- Pointed out more than 96 percent of such patents were applied for by Chinese at home, which means relevant researchers in China still lack the awareness of applying for patent protection abroad and there are few social service agencies that can help them do the application overseas.



生物育种世界范围专利申请人
Biological Breeding World Wide Patent Applicant List

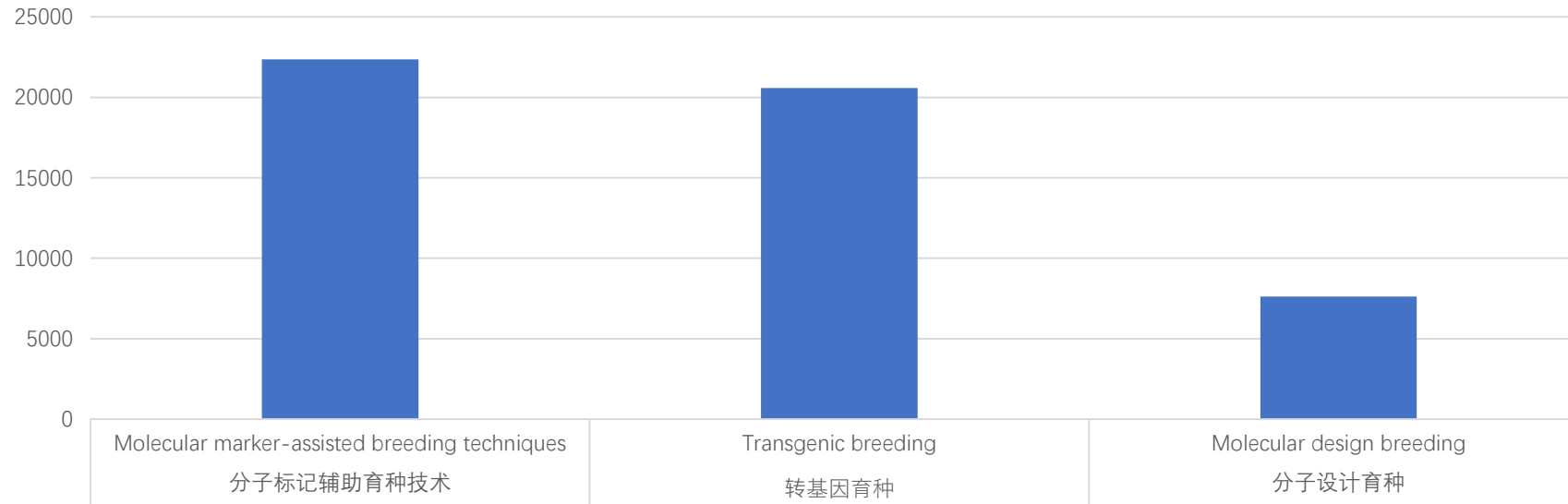
- 中国生物育种专利申请共17万余件，包括国内申请人专利申请共14万件，海外申请人通过PCT途径或者巴黎公约途径进入中国的专利申请共2.5万余件。海外来华专利的来源国家前十位分别为美国、日本、德国、瑞士、英国、荷兰、丹麦、韩国、法国、加拿大。2001年，国内申请人的专利申请首次超过国外专利申请人的申请数量。2008年以后，中国生物育种领域的专利数量开始快速增长。
- There were more than 170,000 patent applications for biological breeding in China, including a total of 140,000 patent applications by domestic applicants and more than 25,000 patent applications by overseas applicants entering China through the PCT route or the Paris Convention route. The top ten countries of origin for overseas patents coming to China were the U.S., Japan, Germany, Switzerland, the UK, the Netherlands, Denmark, Korea, France and Canada. 2001 saw the first time that the number of patent applications by domestic applicants exceeded that of foreign patent applicants, and after 2008, the number of patents in the field of bio-breeding in China began to grow rapidly.



国外来华生物育种专利主要国家分布

Distribution of countries filing patent applications for biological breeding in China

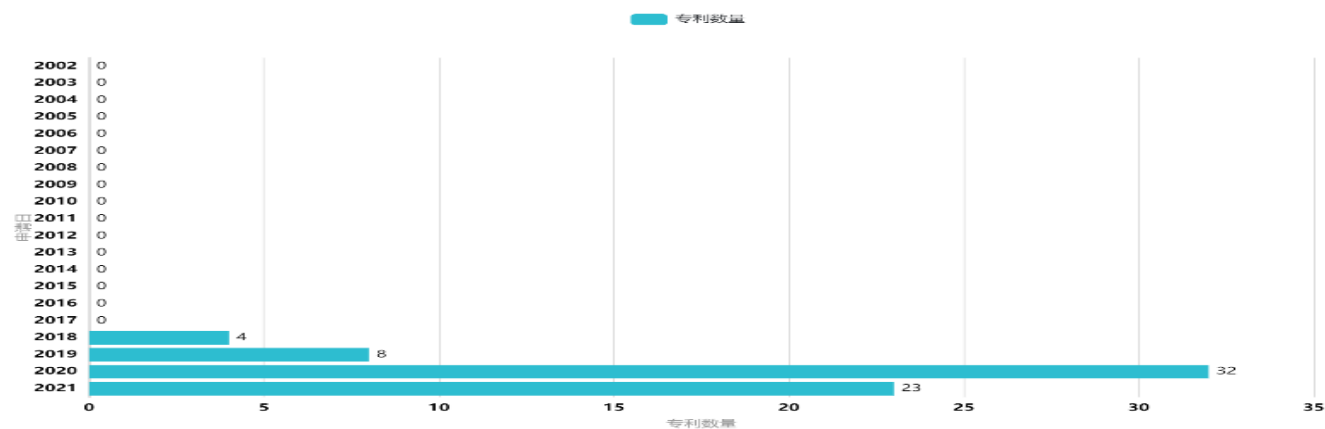
- 在中国的专利申请中，分子标记辅助育种技术相关专利数量最多，共22367件（约占44%）；数量紧随其后的是转基因育种，共20585件（约占41%），分子标记辅助育种和转基因育种作为分子育种领域的两大基石，一直为分子育种领域的研究热点。分子设计育种共7615件（约占15%），这是由于分子设计育种技术兴起较晚，因此专利数量相对较少。
- Among the patent applications in China, the largest number of patents related to molecular marker-assisted breeding technology was 22,367 (about 44%), followed by transgenic breeding with 20,585 (about 41%). Molecular design breeding, with a total of 7615 cases (about 15%), is a relatively small number of patents due to the late emergence of molecular design breeding technology.



- 排名前十位的国内申请人包括浙江大学，中国农业大学，南京农业大学，江南大学，华中农业大学，中国农业科学院作物科学研究所，中国烟草总公司郑州烟草研究院，华南农业大学，中国科学院遗传与发育生物学研究所和江苏省农业科学院。中国分子育种领域排名前十位的国内申请人均为高校和研究机构，说明我国分子育种技术的研究主要集中在大的研究机构和高校。
- 国外来华专利申请中排名前十位的国外申请人包括陶氏杜邦公司、巴斯夫公司、孟山都公司、拜耳公司、帝斯曼公司，加州大学、默克公司、三得利公司、烟业产业和强生公司，可见其对于中国市场的重视。
- The top 10 domestic applicants include Zhejiang University 2207, China Agricultural University 2033, Nanjing Agricultural University 1951, Jiangnan University 1738, Central China Agricultural University 1647, Institute of Crop Science, Chinese Academy of Agricultural Sciences 1335, Zhengzhou Tobacco Research Institute, China National Tobacco Corporation 1145, South China Agricultural University 1136, Institute of Genetics and Institute of Developmental Biology, Chinese Academy of Sciences and Jiangsu Academy of Agricultural Sciences. The top ten domestic applicants in the field of molecular breeding in China are all universities and research institutions, indicating that research on molecular breeding technology in China is mainly concentrated in large research institutions and universities.
- The top ten foreign patent applicants in China include DowDuPont (1226), BASF (611), Monsanto (554), Bayer (319), DSM (270), University of California (199), Merck (199), Suntory (197), Tobacco Industry (186) and Johnson & Johnson (182). (182), showing the importance they attach to the Chinese market.

- 承载国家“南繁硅谷”建设任务的三亚崖州湾地区专利申请量67件，目前其中31件获得了专利授权。专利主要集中在转基因育种领域，在新兴基因编辑育种领域也有部分专利申请。虽然当前专利申请总量较少，但发明专利申请占比较高、专利授权率也较高。我们建议，继续把握三亚崖州湾在作物种质资源和入驻单位机构育种研究方面的基础优势，积极进行专利布局和保护。

- The Sanya Yazhou area, which is tasked with the construction of the national "Silicon Valley of Southern Propagation", has applied for 67 patents, 31 of which have been granted. The patents are mainly in the field of transgenic breeding, with some patent applications in the emerging field of gene editing breeding. Although the current total number of patent applications is relatively small, the percentage of invention patent applications is relatively high and the patent grant rate is also high. We recommend that Sanya Yazhou Bay continue to capitalise on its fundamental advantages in crop germplasm resources and institutional breeding research in the resident units, and actively pursue patent layout and protection.



三亚崖州湾地区专利申请趋势
Trend of Patent Application in Sanya Yazhou Bay Area

[19] 中华人民共和国国家知识产权局



[12] 发明专利说明书

[21] ZL 专利号 01104432.2

[51] Int. Cl⁷

C12N 15/53

C12N 15/62 C12N 15/10

C12N 15/63 A01H 1/06

[45] 授权公告日 2004 年 2 月 4 日

[11] 授权公告号 CN 1137265C

[22] 申请日 2001.2.26 [21] 申请号 01104432.2

[30] 优先权

[32] 2000. 7. 6 [33] CN [31] 00109779.2

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权利要求书 3 页 说明书 12 页

[54] 发明名称 一种提高植物氮素同化效率的方法

[57] 摘要

本发明提供了一种提高植物氮素同化效率的方法, 包括: (a) 将真菌谷氨酸脱氢酶 (GDH) 基因与一种可在植物中引导外源基因表达的启动子相连, 构建嵌合基因; (b) 将构建的嵌合基因导入植物细胞中, 筛选并培养出被转化的植株。

I S S N 1 0 0 8 - 4 2 7 4

生物育种专利具有很高的含金量。

中国专利中被引证次数最高的专利, 就是这件 CN01104432, 培养导入真菌谷氨酸脱氧氢的植株的育种专利, 这件专利的发明人为已故中科院田波院士。

但这件重要专利仅维持6年, 在2010年因为未缴年费专利权终止。

美国专利中被引证排名最靠前的专利, 基本都是涉及到育种的基因专利。

Biological breeding patents are of high value.

The most frequently cited Chinese patent is CN01104432, a breeding patent for the cultivation of plants introducing fungal glutamate deoxygenation, which was invented by the late Academician Tian Bo of the Chinese Academy of Sciences.

However, this important patent lasted only six years and was terminated in 2010 for non-payment of annual fees.

中国生物育种专利存在问题和未来发展

Problems and future development of biological breeding patents in China

- 1.生物育种等先进技术利用深度和广度不足。如国外大豆育种已广泛利用分子辅助选择等现代育种技术，有效提高了育种效率；而我国大豆育种则基本上是常规育种，在育种效率和对具体性状的精确改良方面明显落后。

The current use of advanced biological breeding techniques in China is insufficient. For example, foreign soybean breeding has widely used modern breeding techniques such as molecular assisted selection, which has effectively improved breeding efficiency; while China's soybean breeding is basically conventional breeding, which is obviously lagging behind in breeding efficiency and precise improvement of specific traits.

- 2.核心技术需要突破。以基因编辑育种技术为例，TALEN和CRISPR是基因编辑育种的发展方向，我国虽然在相关技术的应用方面有一定突破，但尚未取得平台技术的核心专利。在关键技术领域如基因编辑作物靶基因开发方面，各大种业巨头尚未进行密集的专利布局，中国需要在该领域加强研发并提前进行专利布局。

Core technologies need to be broken through. For example, gene editing breeding technology, TALEN and CRISPR are the development direction of gene editing breeding, although China has made certain breakthroughs in the application of related technology, but has not yet obtained the core patent of the platform technology. In key technology areas such as gene editing crop target gene development, the major seed giants have not yet carried out intensive patent layout, China needs to strengthen its R&D in this area and carry out patent layout in advance.

- 3.中国在植物生物育种领域的专利数量虽然位列世界第一，但绝大多数专利只在中国申请了保护，缺少专利的国际战略布局。“这一方面是研究人员缺乏去国外申请专利保护的意识，另一方面是目前国内缺乏帮助研究人员申请国外专利保护的社会服务机构。”

China already ranks first in the world in terms of the number of patents in the field of plant biology breeding, the vast majority of patents have only been applied for protection in China, lacking a strategic international layout of patents. "This is partly due to the lack of awareness among researchers to apply for patent protection abroad, and partly due to the current lack of social service institutions in China that help researchers apply for patent protection abroad."

- 4.解决机制障碍推动科研院所和企业的合作。加快建立推动育种业科研创新的新机制，形成研发牵动企业、产业构建市场、市场引导研发的良性循环。

Addressing institutional barriers to promote cooperation between research institutes and enterprises. Accelerate the establishment of a new mechanism to promote research and innovation in the breeding industry, forming a virtuous cycle in which R&D leads to enterprises, industry builds the market and the market guides R&D.

- 谢谢
- Thank you