Technology Promoting Agricultural Supply-Side Reform: An Interpretation of the Agricultural Science and Technology Development Layout in the Chinese Academy of Sciences' 13th Five-Year Plan (Postprint)

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Abstract

China' s agricultural transformation and development faces severe challenges going forward, with ensuring the supply of major agricultural products such as grain becoming an increasingly arduous task, urgently necessitating theoretical and technological innovation. During the 13th Five-Year Plan period, the state issued a series of policies and plans to advance agricultural supply-side reform. The Chinese Academy of Sciences will continue to leverage its talent highland advantage, continuously conducting research and development with "seed industry development," "soil fertility improvement," and "green agricultural technology" as the main themes, focusing on solving major scientific problems in agriculture; tackling generic key technologies; conducting regional agricultural industry technology integration and carrying out demonstrations for optimizing agricultural resource allocation; and continuously providing new ideas, technologies, and methods for sustainable agricultural development. This article analyzes the connotation of supply-side reform and provides an interpretation of the agricultural technology development in the Chinese Academy of Sciences' 13th Five-Year Plan from the above three aspects.

Full Text

Promoting Supply-Side Structural Reform in Agriculture through Science and Technology: An Interpretation of the Agricultural Technology Development Layout in the 13th Five-Year Plan of the Chinese Academy of Sciences

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Abstract
China's agricultural transformation and development face severe challenges, and the task of ensuring the supply of grain and other major agricultural products has become increasingly arduous, urgently requiring theoretical and technological innovation. During the 13th Five-Year Plan period, the state has issued a series of policies and plans to advance agricultural supply-side structural reform. Leveraging its advantages as a national talent hub, the Chinese Academy of Sciences (CAS) will continue to focus its research and development on three main thrusts: "seed industry development," "soil productivity improvement," and "green agricultural technology." CAS aims to focus on solving major scientific problems in agriculture, overcome common key technologies, conduct integrated demonstration of regional agricultural industrial technologies, and carry out demonstrations for optimizing agricultural resource allocation, thereby continuously providing new ideas, technologies, and methods for sustainable agricultural development. This paper analyzes the connotation of supply-side reform and interprets the agricultural technology development layout of CAS' s 13th Five-Year Plan from the above three aspects.

Keywords
Agriculture, Chinese Academy of Sciences, planning, supply-side structural reform

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Severe Challenges and Development Opportunities Facing China' s Agricultural Production

First, relative to its population and land area, China is a country with seriously insufficient agricultural resources, particularly arable land. Per capita arable land accounts for only 32% of the world average and 10% of that of the United States. According to the *2015 China Land and Resources Bulletin*, by the end of 2015, the nation' s arable land area totaled 135 million hectares (2.025 billion mu). After excluding land unsuitable for cultivation due to moderate or severe pollution and land with damaged surface soil layers caused by mining subsidence, only 120 million hectares (1.8 billion mu) remain suitable for stable utilization. Among this arable land, low- and medium-yield fields account for 84 million hectares (1.27 billion mu), nearly 70% of the total, while high-yield fields amount to only 36 million hectares (550 million mu). Moreover, the area of high-yield fields is decreasing annually as quality land is occupied by urban expansion nationwide [1]. It is reported that between 1996 and 2009, just five provinces—Jiangsu, Zhejiang, Fujian, Guangdong, and Guangxi—lost 1.19 million hectares (17.98 million mu) of paddy fields, equivalent to the entire paddy field area of Fujian Province [2].

Second, the uneven regional distribution of water and land resources relative to population further exacerbates the 困境 (predicament) caused by the contradiction between population and land, creating imbalances in both arable land scarcity and water resources. The northern region possesses 60% of the nation' s arable land but only 20% of its total water resources [3]. Several major grain-producing provinces such as Hebei and Shandong suffer from severe water shortages, yet they are also major grain production and export provinces. As population growth, aging, and labor shortages (particularly rural labor) become increasingly prominent, the demographic dividend brought by labor resource advantages is also disappearing.

To meet grain production demands and obtain returns from limited land, the vast majority of agricultural producers and farmers in China excessively rely on chemical fertilizers and pesticides to achieve high yields in the short term on infertile land. This input approach has, on the one hand, led to continuously rising grain costs, triggering price inversions where "foreign goods enter the market while domestic goods go to storage" —a phenomenon particularly evident in corn imports and exports. On the other hand, excessive use of chemical fertilizers and pesticides not only reduces agricultural product quality but also causes these chemicals to wash into rivers with rainwater, seep into soil, and disperse into the atmosphere, eroding the surrounding environment and air quality to varying degrees.

The contradiction between population and land has forced most regions in China to utilize land to its maximum capacity. For instance, the multiple cropping index has reached 1.6, making China the country with the highest multiple cropping index worldwide. Without fallow periods or natural recovery, production relies entirely on high inputs of chemical fertilizers and irrigation, leading to continuously declining soil productivity, severe soil erosion, and vulnerability to water and soil loss [4].

The "small-scale farming model with fragmented land management" in China has pushed grain production into an increasingly narrow space, with yield growth flattening. After 2014, China's total grain output deviated for the first time from the trend of synchronized fertilizer input and yield increases; increased fertilizer use no longer stimulated crop yield growth, and overall fertilizer usage has reached the saturation level that soil can bear. In 2016, grain output declined for the first time after twelve consecutive years of growth.

Meanwhile, changes in residents' dietary structure and increasing consumption of animal products have posed new demands on grain demand structure. The convergence of these contradictions has made the traditional path of "competing on resources and inputs" unsustainable, urgently requiring transformation of agricultural production methods and resource utilization approaches.

Despite these severe challenges, opportunities for transforming production methods and promoting industrial development through input of scientific and technological elements remain optimistic. The concentrated distribution of low- and medium-yield fields and some saline-alkali land that can be reclaimed, while currently problematic, also represent new potential for increasing soil productivity and promoting grain and agricultural production through technological investment. Moreover, continuously upgrading consumption demands provide strong market traction for agricultural supply-side reform. The core of agricultural supply-side structural reform is reflected in two aspects: first, improving the comprehensive efficiency of agriculture; second, enhancing the international competitiveness of agricultural products. Accelerating the rational adjustment of agricultural production structure, continuously integrating domestic and foreign grain and agricultural product markets, and deepening exchanges between Chinese and foreign agricultural enterprises will expand the adjustment space for China' s agricultural industry development and provide opportunities for creating agricultural transformation and upgrading.

Review of Key Agricultural Science and Technology Innovation Work During the 12th Five-Year Plan

Solving major scientific and key technological problems related to the nation' s long-term development is the historical mission of CAS and a strategic field it has long focused on, as well as a key target for deployment at each stage. During the 12th Five-Year Plan period, facing the nation' s enormous demand for increasing grain production quantity and bottlenecks encountered in breeding superior varieties—the most important contributing factor in crop production—CAS launched two strategic pilot science and technology projects: the "Molecular Module Design Breeding Innovation System" (Category A) [5] and "Targeted Prevention and Control of Crop Diseases and Pests" (Category B). These initiatives aimed to break through the constraints of traditional breeding, avoid public acceptance barriers to transgenic breeding, and open new technical pathways for "modular" molecular design breeding, as well as establish a new technical system for biological control by utilizing information flow between organisms. To date, 76 important molecular modules and 33 important application-valued molecular modules have been identified in rice, wheat, and other crops, and more than 30 new crop lines suitable for stress resistance have been bred, laying a solid foundation for realizing true molecular design breeding. In terms of important gene cloning, the acquisition of the key gene IPA1 can effectively control ideal plant architecture in rice and further increase yield [6]. The first discovery of plant low-temperature receptors revealed the molecular cytological mechanism by which artificial domestication confers cold tolerance to japonica rice [7]. These important discoveries have attracted attention and high praise from domestic and international peers and have tremendous application potential in molecular design breeding for stable rice production. Significant progress has also been achieved in the targeted prevention and control of crop diseases and pests, particularly in the identification of information flow and crop immune responses to diseases and pests. The structural analysis of the photosynthetic membrane protein supercomplex of higher plant Photosystem I also provides theoretical basis and important pathways for biomimetic simulation, exploring solar energy utilization, and improving crop light energy use efficiency [8]. All these scientific advances have generated tremendous impact and were selected for the "2010 Top Ten Scientific Advances in China," "2010 Top Ten Science and Technology News in China" (as voted by academicians of the two academies), and "2015 Top Ten Advances in Life Sciences in China." The application of new gene editing technology in crops has yielded the world' s first powdery mildew-resistant wheat and fragrant rice germplasm materials. The number of original papers published by CAS in international mainstream journals such as *Cell*, *Nature*, and *Science* has increased dramatically, becoming a potential input element continuously driving agricultural industry development [9-15].

These achievements demonstrate that China' s agricultural science and technology innovation has gradually moved from tracking and imitation to running in parallel with international advances, and in some directions has taken the lead.

Facing strong demand for balanced regional agricultural production increases, CAS organized and implemented key scientific and technological breakthroughs leading to integrated demonstration of regional agricultural technologies, achieving substantial results. (1) In coastal saline-alkali areas, the "Bohai Granary" science and technology demonstration project was implemented, embodying the concept of "storing grain in land and storing grain in technology." By utilizing saline water, treating saline-alkali land, and improving soil, it provided a pioneering example for soil quality improvement and cost-efficiency enhancement, transforming poor land into granaries. By the end of 2016, demonstration and radiation areas in Hebei, Shandong, Liaoning, and Tianjin had achieved yield increases of 5.6 billion jin and efficiency gains of 3.3 billion yuan. (2) In the southern Huang-Huai region, the "Second Granary" science and technology demonstration project was launched to improve mortar black soil. Following the principles of soil productivity improvement and green high yield, focusing on more than 20 million mu of mortar black soil farmland in northern Anhui, it created a demonstration model for agricultural transformation and development in the Huai River basin. Two years after implementation, the core area in Guoyang County formed more than 600,000 mu of ton-grain fields, with cost savings and efficiency gains of over 100 yuan per mu per year, while also demonstrating and promoting 300,000 mu, entering the "ton-grain county" category one year ahead of schedule. This formed a pattern of "hundred-mu experimentation, thousand-mu demonstration, and ten-thousand-mu radiation promotion" for technology-driven grain increase. This process also spawned numerous small agricultural enterprises, practicing the concept of "mass entrepreneurship and innovation." (3) In the Bohai Sea area, the "Marine Ecological Ranch" was established to coordinate nearshore water quality improvement with healthy aquaculture. By integrating environment-friendly nearshore aquaculture and marine ranch construction technologies, creating new varieties of fish, shrimp, sea cucumbers, shellfish, and algae, and developing intelligent aquaculture equipment, a healthy breeding and high-value utilization system using natural bait and natural ecosystem self-circulation was realized. The nearshore sea area transformed from a seabed desert into a "marine ranch" producing more than 200 kg of seafood per mu annually, with significantly improved water quality, achieving mutual benefits for production and ecology. (4) In the typical grasslands of Hulunbuir, an "Ecological Grassland Farming" demonstration zone was established to coordinate ecology, production, and livelihood. Based on the long-term exploration and design of the "Ecological Grassland Farming" development concept [16], aiming to solve problems of low productivity, low coverage, low proportion of high-quality forage, and dysfunctional ecological and production functions, it constructively combined artificial grassland establishment with natural grassland restoration in a "1:9" model, practicing it on the Hulunbuir grasslands. By developing artificial grasslands to create space for natural grassland recovery and shortening recovery time through rapid improvement of natural grasslands, a complete industrial chain of "grass cultivation—grass processing—livestock raising—processing" was built, achieving improvements in ecological environment, production performance, and herders' lives. This work has attracted the attention of national leaders and was incorporated into the Central No. 1 Documents of 2015, 2016, and 2017.

In response to growing food safety and environmental problems caused by excessive application of chemical fertilizers and pesticides, CAS has proactively deployed green agricultural technology research and development. Following the approach of simultaneous research and demonstration, continuous deployment in environmentally friendly fertilizers and synergists, plant growth and immune regulators, botanical pesticides, and biological control using insect virus pesticides has yielded visible results. S-inducer based on ABA (abscisic acid), slow-release/controlled-loss fertilizers, and fertilizer synergists have been successively commercialized and demonstrated at scale for various vegetables, goji berries, potatoes, and rice in Ningxia, Shandong, Hainan, and other locations, achieving remarkable economic and ecological benefits.

To promote agricultural informatization construction, an agricultural IoT demonstration based on IoT applications was established. It has played a core technical supporting role in the material circulation traceability system of China National Agricultural Materials Corporation and the National Agricultural Supply and Marketing Cooperatives, as well as in the construction and development of agricultural IoT in Anhui and Tianjin.

In terms of smart agricultural machinery, the intelligent transformation of foreign large-scale agricultural equipment was centrally demonstrated in the "Northeast Academy-Army Modern Agricultural Technology Demonstration."

Regarding plant germplasm resource utilization, using wild germplasm resources of kiwifruit and grapes collected and preserved in botanical gardens as a starting point, new kiwifruit and grape varieties have been successfully developed, promoting industrial development and upgrading.

As land transfer accelerates, scaled production methods such as family farm operations will undoubtedly be the inevitable direction of future agricultural development [17,18]. However, the diversity of China' s arable land, population, ecology, and climate, as well as unbalanced socioeconomic development, means that China cannot simply copy farm management models from developed countries. Therefore, "tailoring measures to local conditions" is the main approach for scaled operations in different regions. In terms of strategic research on agricultural development, CAS has also conducted in-depth analysis, discussion, and practical demonstration of suitable farm management models and their positioning for different regions in China. It is proposed that for regions with vast land and abundant resources such as Northeast China, intensive heavy mechanization operations with 500-1,000 mu per capita are suitable; for the Huang-Huai-Hai region with flat terrain, convenient irrigation conditions but relatively dense population, moderately intensive medium-scale machinery farming with 300-500 mu per capita is appropriate; and for the gently rolling semi-hilly areas of North China and southern regions, small family farm models within 100 mu are more suitable [19].

In poverty alleviation and development, CAS has always been a pioneer and pathfinder, and was the initiator and advocate of the "National Eight-Seven Poverty Alleviation Program." Over the past 30 years, CAS has gradually formed three science and technology poverty alleviation models: science and technology project-based poverty alleviation, industry development-linked poverty alleviation, and long-term station-based poverty alleviation relying on field stations, generating three poverty alleviation models: non-local shareholding system poverty alleviation, non-local relocation poverty alleviation, and technology introduction poverty alleviation. During the 12th Five-Year Plan period, CAS conducted extensive science and technology poverty alleviation work in Huayuan (Hunan), Huanjiang (Guangxi), Kulun (Inner Mongolia), Shuicheng and Liuzhi Special Zone (Guizhou), the "One River and Three Tributaries" basin in Tibet, southern Xinjiang, and some old revolutionary base areas, adapting measures to local conditions. Through rocky desertification control and non-point source pollution prevention, ecological environments were improved; characteristic economic crops such as kiwifruit, potatoes, and hybrid paper mulberry were introduced to create thousand-mu demonstration parks, driving local characteristic economic development; and training courses on variety breeding and cultivation technology were held to change traditional mindsets and disseminate new technologies and knowledge. In 2015, CAS undertook the national third-party assessment task for poverty alleviation effectiveness through competitive bidding. Through extensive research and analysis, it compiled the *Third-Party Assessment Report on the Implementation of Major Policies and Measures for* "*Targeted Poverty Alleviation and Targeted Poverty Elimination*" and special research reports. In 2016 and 2017, CAS was commissioned by the State Council Leading Group Office of Poverty Alleviation and Development to conduct third-party assessments of poverty alleviation effectiveness for two consecutive years, providing important guidance for targeted poverty alleviation, addressing weaknesses, and improving poverty alleviation results, which has been recognized by the Party and the state.

Strategic Layout of CAS Agricultural Science and Technology for the 13th Five-Year Plan

Promoting agricultural development and solving the "three rural issues" (agriculture, rural areas, and farmers) have long been goals of the central and local governments as well as the scientific community. After decades of effort, agricultural development methods in various parts of China have changed to varying degrees, and science and technology service capabilities have significantly improved, promoting regional economic development. However, due to the complexity of China' s agricultural problems, their broad scope, and the huge agricultural employment population, the task of thoroughly resolving deep-seated structural contradictions hindering agricultural development remains arduous. Issues such as insufficient international competitiveness of agricultural products, uncoordinated supply-demand matching capabilities, numerous impoverished populations, and insufficient sustainable development capacity cannot be completely transformed in the short term. Solving these problems requires not only national policy-level targeted measures but also adherence to the new development concepts of "innovation, coordination, green development, openness, and sharing," with problem orientation, to deeply advance agricultural supply-side reform and promote agricultural industry development and growth through input of scientific and technological elements.

The Central No. 1 Document has focused on "three rural issues"for 14 consecutive years. At the beginning of the 13th Five-Year Plan, the Central No. 1 Document proposed promoting agricultural supply-side structural reform, using new development concepts to solve new problems in "three rural issues," and following a path of agricultural modernization with high efficiency, product safety, resource conservation, and environmental friendliness. In 2017, promoting agricultural supply-side structural reform became the theme of the Central No. 1 Document. A thorough reading of the document reveals that promoting agricultural supply-side reform requires efforts in five aspects: (1) fundamentally solving the problem of insufficient agricultural science and technology supply through scientific and technological innovation and institutional innovation, including increasing agricultural science and technology investment, improving mechanization levels, promoting smart agriculture development, facilitating rational industrial chain layout, and enabling scientific agricultural industry development; (2) adjusting production relations to better adapt to productive forces, advocating intensive and scaled operations according to local conditions, leveraging agricultural industrial scale effects, improving agricultural production efficiency, and creating applications for advanced agricultural equipment and technology; (3) producing higher quality, safer agricultural products that do not cause environmental damage based on market demand; (4) leveraging the principal role of farmers by creating innovative environments and favorable conditions for them to actively participate in supply-side reform and share reform dividends; and (5) actively leveraging the role of enterprises, which have stronger capabilities than individual farmers in market analysis, technology development, and risk resistance, to drive the upgrading and transformation of the entire agricultural industry through agricultural enterprise development.

Undoubtedly, scientific and technological progress is the primary productive force in agricultural development. Promoting agricultural supply-side structural reform must first rely on the guidance and support of science and technology. In response to the Central No. 1 Document, various ministries have successively issued the *National Agricultural Comprehensive Development High-Standard Farmland Construction Plan* for transforming low- and medium-yield fields, deployed multiple "National Key R&D Programs" oriented toward the national economic main battlefield, continued implementing the *Transgenic Biological New Variety Cultivation Science and Technology Major Project* and the *National Modern Crop Seed Industry Development Plan* aimed at improving China's biological breeding capabilities. The implementation of these large-scale national plans provides demand-driven traction for CAS to continue leveraging its talent hub advantages, focusing on solving major agricultural scientific problems and overcoming common key technologies, and conducting full-industrial-chain collaborative research and demonstration oriented toward quality and efficiency improvement and market supply elements. It also provides primary economic resources for the main thrusts of "seed industry development," "soil productivity improvement," and "green agricultural technology," injecting scientific and technological momentum into the struggle to achieve "agricultural efficiency, farmer income increase, and rural greening."

Focus on Major Scientific Issues

To serve common technologies and agricultural industry demonstration, and to provide basic theories and gene resources for building food, livestock product, and ecological environment security systems, CAS will conduct explorations from micro-mechanisms to macro-agricultural ecological management systems for plants, livestock, and aquatic organisms.

(1) **Aiming to deeply explore plant directional development mechanisms**, CAS will analyze the genetic basis and evolutionary laws of trait formation, material and energy metabolism mechanisms of morphological development, and molecular regulatory mechanisms of growth and development. It will also analyze signal perception and transduction mechanisms

under biotic stress (drought, salinity, etc.) and abiotic stress (pest and disease), and explore plant stress response mechanisms under environmental stress.

(2) **Aiming to improve feed conversion efficiency and product quality of domestic animals**, CAS will analyze the functional basis of gastrointestinal digestion and absorption, nutritional regulation mechanisms, immune response mechanisms to intestinal environmental factors, and the formation laws of livestock product quality in livestock and poultry, and explore ecological nutrition mechanisms for healthy livestock and poultry farming.

(3) **Aiming to breed new aquatic organisms with high production performance**, CAS will analyze the genetic basis of major economic traits such as reproduction and sex determination, growth and disease resistance, hypoxia and low-temperature tolerance, clarify polyploid genome evolution laws, and conduct key basic theoretical research on design breeding.

(4) **Aiming to optimize agricultural ecological systems**, CAS will analyze energy and material transformation mechanisms for structural and functional optimization of agricultural ecosystems, interactions between organisms and their physical and chemical environments, environmental factor matching mechanisms for superior variety trait expression, and reveal principles of agricultural ecosystem management and regulation.

Tackling Key Common Technologies

Aiming to drive revolutionary changes in breeding concepts for seed industry development, promote core technologies for efficient and sustainable agricultural development, and develop key technologies that can be implemented and transformed, CAS will add scientific and technological driving elements for advancing agricultural supply-side structural reform and promoting agricultural transformation and upgrading.

(1) **Aiming to promote the streamlining and informatization of design breeding and improve crop breeding efficiency and shorten breeding cycles**, CAS will optimize gene-directed editing technologies for molecular design breeding and trait improvement, interspecific (or subspecific) hybrid transfer technologies, high-throughput, intelligent, and precise trait testing technologies, network computing and trait simulation technologies, and modular assembly technologies. It will also establish breeding decision-making platforms and high-throughput phenotyping platforms serving seed industry and industrial demonstration bases.

(2) **Aiming to reduce ecological environmental pressure from agricultural production, lower resource costs, and rationally allocate agricultural resources**, CAS will optimize key technical systems from the perspective of building healthy agricultural ecosystems. This includes

crop planting structure layout and regional precise allocation technologies, planting-breeding composite ecosystem construction and regulation technologies, obstacle soil factor elimination and remediation technologies, and efficient water and fertilizer utilization technologies to alleviate resource and environmental carrying pressure and reduce the cost of sacrificing natural resources for sustained grain production and agricultural development.

(3) **Aiming to strongly support agricultural informatization and intelligentization construction**, CAS will focus on developing source technologies and core devices and chips for informatization. This includes optimizing information monitoring and IoT systems serving precision crop production and healthy livestock and aquaculture, as well as technologies for accurate soil component determination, high-throughput crop phenotyping, individual livestock behavior determination, and high-precision, high-density water body monitoring. CAS will break foreign monopolies on source technologies and their core devices and chips, and build an agricultural sensor and IoT system.

Regional Demonstration and Integration of Agricultural Industry Development Technologies

Aiming to face the national economic main battlefield, focus on bottlenecks in regional agricultural development, and significantly improve regional sustainable development capabilities, CAS will conduct in-depth and detailed analysis of major problems affecting regional agricultural industry development, optimize and systematically integrate core key technologies.

CAS will continue advancing the "Bohai Granary"science and technology demonstration project centered on utilizing brackish water and saving groundwater; deeply implement the "Second Granary"science and technology plan in the southern Huang-Huai region to overcome mortar black soil obstacle factors and wheat scab infection, following the principle of "storing grain in land" ; develop key technologies for eliminating soil obstacle factors in low- and medium-yield fields and resisting scab; conduct research and demonstration of new technologies for engineered construction of high-quality tillage layers in low- and medium-yield fields to tap yield and efficiency improvement potential and expand the scope and enabling technologies for low- and medium-yield field transformation.

Building on successful pilots, CAS will launch and implement the "Ecological Grassland Farming" demonstration zone construction across the Inner Mongolia Autonomous Region to expand the radiation area, further enhance the coordination between grassland production and ecological functions, promote grassland-livestock coupling, and improve livestock product quality. It will continue advancing the scale and scope of the "Marine Ecological Ranch"demonstration zone to restore damaged habitats, form a stable three-dimensional mixed-culture marine ecological ranch system, and gradually expand the demonstration scope of marine ecological ranches to coastal saline water basins with integrated land-sea development.

In these science and technology demonstration projects, CAS will fully leverage its leading advantages in green agricultural technology, continue focusing on biological control technology innovation and chemical fertilizer and pesticide reduction and efficiency enhancement, analyze the migration and transformation characteristics of chemical fertilizers and pesticides, explore the coupling and synergistic mechanisms between fertilizers and plant nutrient supply and demand, and continuously develop new biological pesticides and biological agents, waste resource utilization and harmless treatment technologies, and composite ecological planting and breeding technologies to demonstrate integrated green agricultural clean production technologies.

Simultaneously, focusing on the national "Silk Road Economic Belt"and Yangtze River Economic Belt construction, and considering the natural conditions and agricultural resource endowments of western China, CAS will conduct research and development on characteristic agricultural product variety breeding and industrial technologies to promote county-level characteristic industry development. In the Yangtze River Economic Belt, it will promote the "Ecological High-Value Healthy Aquaculture" model to facilitate efficient and clean development of large-scale aquaculture and freshwater fisheries, establishing an environmentally friendly and efficient production new business format. Against the backdrop of the "Industry 4.0 Era," CAS will explore the establishment of intelligent "plant factories" to significantly reduce labor requirements, improve production efficiency, lower costs, and move toward practical application.

China will fully achieve the poverty alleviation task for the impoverished population by 2020. In response to the national-assigned assistance tasks and assistance requirements from local governments to CAS branches, CAS has formulated a 13th Five-Year poverty alleviation plan, designated regional coordinating branches and responsible research institutes for each task, and dispatched deputy county heads for science and technology and first secretaries in villages. For each designated poverty alleviation county, CAS helps formulate personalized poverty alleviation development plans, implements industry assistance science and technology demonstration projects, and precisely helps poor households escape poverty and become prosperous. Simultaneously, CAS organizes forces to complete various third-party assessment tasks entrusted by the state and relevant departments with high quality.

Conclusion

Under the guidance of CAS' s "Three Orientations" (orienting toward world science frontiers, national major needs, and the national economic main battlefield) and "Four Firsts" (first to achieve scientific and technological innovation, first to build a national high-level science and technology think tank, first to build a first-class scientific research institution, and first to build a first-class scientific research talent team) policy, through unremitting efforts at both the academy and institute levels and by numerous scientific researchers, CAS has formed a coordinated and unified layout facing world science frontiers, national major needs, and the national economic main battlefield. "Problem orientation and demand-based approach" has become the consensus of the vast number of scientific and technological personnel. In the field of agricultural science and technology, CAS has initially opened up the connection channel from basic theory and core technology to industrial implementation, realizing the transformation from "individual operations" to "joint operations," and implementing advanced demonstrations for the transition from traditional agriculture to scaled modern agriculture.

However, promoting agricultural supply-side structural reform and realizing the transformation of agricultural development methods is an arduous task in China' s agricultural industry development, closely related to new-type industrialization, urbanization, and informatization. This cannot be accomplished overnight but requires long-term effort and persistence. Building on existing work and combining it with the new requirements for agricultural transformation and development during the 13th Five-Year Plan period, CAS will remember its mission and responsibility as a national science and technology team, continuously leverage its multidisciplinary intersection advantages, integrate superior resources within the academy, focus on core key issues for research and demonstration, and continuously provide new ideas, technologies, and methods for sustainable agricultural development.

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