

OVERVIEW OF THE DEVELOPMENT OF AGRICULTURAL TECHNOLOGY EXTENSION IN CHINA*

National Agricultural Technology Extension and Service Center (NATESC)

Beijing, China

Contact Tel.: 0086 10-59194545, or 0086 10-59194352

Since the reform and opening up of China's economy, its agriculture has made extraordinary achievements that attract the world's attention. China's grain production has increased four times to a different level and has been above 500 million tons per year, providing food for 21% of the world population with merely 9% of the world's arable land. Farmers' per capita income has increased from RMB 134 in 1978 to RMB 6,977 in 2011, which allowed the significant improvement of the people's living standard. Until 2011, total grain production and yields have experienced eight years of consecutive growth to reach a total of 571 million tons. In these achievements, the extension and application of agricultural science and technology has played a significant role, and the agricultural technology extension system has made an essential contribution.

China's agricultural technology extension system is a government-built organization to provide public agricultural service. Agricultural technology extension system for crop farming has the longest history, the most members and the widest service clientele. With the objective of serving the "three rural dimensions" of "agriculture, farmers, and rural areas" in a sustainable way, it has played an irreplaceable role in actively communicating and implementing the policies of the Communist Party of China (CPC) through monitoring and increasing the public knowledge of agricultural technology, and in demonstrating and extending advanced and applicable agricultural technologies. It serves as a significant science & technology support and it has made a great contribution to achieving annual production of 500 million tons and the realization of the "eight-year consecutive growth".

I. General information about the crop farming technology extension system in China

China agricultural technology extension system covers four industries, that is, crop farming, animal husbandry, aquaculture and agricultural machinery. This article will focus mainly on crop farming.

The crop farming technology extension system includes five government administrative levels (national, provincial, prefectural, county, and town levels), agricultural technology personnel and rural technology demonstration households. At the national level, the National Agricultural Technology Extension and Service Center provides comprehensive services targeted at the main agronomical subjects, such as cultivation, seed,

* Background Paper prepared for the Roundtable Consultation on Agricultural Extension, Beijing, March 15-17, 2012.

soil fertilizer, plant protection and horticulture (cash crops). At the provincial, prefectural and county levels, the agricultural technology extension departments are created accordingly in a similar fashion. And at the town level, the agricultural technology extension departments are combined into a comprehensive agricultural service center. It is estimated that there are about 30,000 crop farming institutions with about 300,000 members throughout China in 2011. According to the sampling survey and analysis in 2011, the number of the crop farming technology extension institutions of central, provincial, prefectural and county-levels was almost equal to the previous year, and the number of these institutions at the town level in 2011 slightly decreased by comparison with that in the previous year. With respect to the management mechanism, the percentage of the town-level planting technology extension institutions under the management of county-level competent agricultural departments was increased to about 40%, while 15% were under the management of the town-level government, and about 45% were under dual management of town-level and county-level governments. The quantity of personnel followed the downward trend, while the percentage of the personnel with college degree and higher constantly increased, college degree accounting for 35%, bachelor's degree accounting for 23%, master's degree and above accounting for 1.5%. The percentage of personnel with technical titles constantly increased, with junior title accounting for 31%, intermediate one accounting for 32%, senior one accounting for 9% and technology extension researchers accounting for 1%.

II. Development process of agricultural technology extension system in China

Since the reform and opening up, the agricultural technology extension in China has experienced three stages: recovery stage, consolidation stage and innovation stage.

(I) Recovery stage

In 1982, Document No. 1 of the CPC Central Committee stated, "We should recover and improve the agricultural technology extension institutions at various levels, consolidate and strengthen technology, attach importance to good operation of the county-level technology extension institutions, gradually combine technology extension, plant protection and soil fertilizer, and realize the unified leadership and division of work for comprehensive use of technologies in production". In the same year, Ministry of Agriculture, Animal Husbandry and Fisheries established National General Agricultural Technology Extension Station, changed Plant Protection Bureau and Seed Bureau into National General Plant Protection Station and National General Seed Management Station respectively, and built National General Soil Fertilizer Station in 1986. These symbolized the embryo of modern agricultural technology extension system.

In 1983, Ministry of Agriculture, Animal Husbandry and Fisheries issued *Regulations on Agricultural Technology Extension* (for trial implementation), which provided detailed regulations on the institution, functions, staffing, team, funding, punishment and reward of agricultural technology extension. In 1983, Document No. 1 of the CPC Central Committee explicitly pointed out, "In addition to winning the salary income, the agricultural technology personnel may be allowed to sign work contracts with economic

organizations and obtain bonus from the increased production pro rata”. In the same year, the State Council Document No. 74 made the decision “The salary of the agriculture and forestry technology extension personnel below the county level (not including the county level) shall be raised to the next higher level”. This signified the policy guarantee for agricultural technology extension personnel’s salary.

In 1984, Ministry of Agriculture, Animal Husbandry and Fisheries issued *Trial Regulations on Agricultural Technology Contract Responsibility System* to encourage agricultural technology personnel to go down to the basic level and carry out technology contracting activities, with the aim to popularize technology with economic means.

In 1985, Document No. 6 of the CPC Central Committee stated, “the technology accountability system linked with economic benefit and return ought to be promoted, so are the methods of charging technical service fees, so that the income of agricultural technology extension institutions and science & technology personnel shall increase with the income of farmers. Technology extension institutions may launch enterprise-type business entities”.

In 1989, the State Council Document No. 78 raised the requirements to strengthen the extension and application of agricultural science and technology results, establish and improve various agricultural technology extension and service organizations, and further stabilize and develop the science and technology teams in rural areas. This indicated that the functions of the agricultural technology extension system at the grassroots level have been expanded from free-of-charge technology extension to paying for service, and preliminary exploration has been made on the operation mechanism and ways and means catering to the need of agricultural production and economic development in rural areas.

(II) Consolidation stage

In 1991, the State Council Document No. 59 highlighted that, “To encourage junior college and technical secondary school graduates to serve on the front line of rural areas, it is determined that the town-level agricultural technology extension institutions are defined as the nation’s public institutions at the grassroots level. The staffing and funds shall be provided by provinces, autonomous regions or municipalities according to the need and their respective financial status”.

In 1993, “*Law of the People's Republic of China on the Popularization of Agricultural Technology*” was promulgated and implemented, indicating that the agricultural technology extension development stepped onto the legalized track in China.

In 1996, Document No. 2 of the CPC Central Committee raised that “The governments at all levels shall increase the funds on agricultural technology extension, carry out a comprehensive check on the

characterization, fixing of staffing number, delimiting of staffing structure and the fund guarantee for agricultural technology extension, for practical implementation within this year according to relevant national regulations”. The promulgation of these documents boosted the construction of town-level agricultural technology extension institutions and the implementation of “characterization, fixing of staffing number and delimiting of staffing structure”.

In 1998, Document No. 13 of General Office of the CPC Central Committee further required that during the institutional reform, the technology extension system shall ensure “institutions are in good order, personnel go together, network is uninterrupted and the fund is not reduced”. In 1998, the Third Plenary Session of the Fifteenth CPC Central Committee raised the basic framework of rural economic system of “being based on the household responsibility system, and supported by agricultural service system, agricultural product market system and national support system for agriculture”. In the same year, Ministry of Agriculture established the leading group of agricultural service system to make overall planning and coordinate the construction of five systems for crop farming, animal husbandry and veterinary medicine, agricultural mechanization, aquaculture, and rural operation and management.

In 1999, considering the influence on the agricultural technology extension system at the grassroots level during the institutional reform in some regions, Ministry of Agriculture worked with State Commission Office for Public Sector Reform (SCOPSR), Ministry of Human Resources and Social Security and Ministry of Finance to draft *Opinions on Stabilizing the Agricultural Technology Extension System* and reported it to the State Council, which was transmitted by General Office of the State Council.

(III) Innovation stage

In 2000, after General Office of the CPC Central Committee and General Office of the State Council issued Document No. 30, the various agricultural technology extension institutions at the town level were merged to become the comprehensive agricultural service centers in various places, and the “personnel right, financial right and property right” was transferred from the county level to towns.

In 2002, Document No. 2 of the CPC Central Committee stated, “Continue promoting agricultural science and technology system reform, and gradually build the agricultural technology extension system that can undertake operation service and public functions respectively”.

In 2003, Ministry of Agriculture drafted Nong Jing Fa [2003] No. 5 Document, and joined hands with State Commission Office for Public Sector Reform (SCOPSR), Ministry of Science and Technology, Ministry of Finance, Ministry of Human Resources and Social Security to carry out the reform pilot work for agricultural technology extension system at the grassroots level in 12 provinces and municipalities directly under the Central Government. In the same year, Ministry of Agriculture together with SCOPSR, Ministry of Science and

Technology, Ministry of Finance and Ministry of Human Resources and Social Security jointly held the conference in Beijing on the grassroots level reform pilots of agricultural technology extension system.

In 2005, these five ministries and offices jointly reported *Report on Reform Pilot of Agricultural Technology Extension System at the Grassroots Level* to the State Council. In the same year, Ministry of Agriculture launched the nationwide innovation pilots program for agricultural technology extension and operation system at the grassroots level. With the pilot reform, significant results were achieved in the reform of agricultural technology extension system and the innovation of mechanism, which have unified the understanding, accumulated the experience and laid the foundation for the issuance of the State Council Document No. 30 in 2006 and for comprehensive promotion of the reform and building of the agricultural technology extension system at the grassroots level.

In 2006, *Opinions of the State Council on Deepening Reform and Strengthening the Building of Agricultural Technology Extension System at the Grassroots Level* (Guo Fa [2006] No. 30) was promulgated, which required that to strengthen the reform of agricultural technology extension system at the grassroots level according to the requirements of strengthening public functions and enlivening operation service. Through a series of reforms (such as defining the functions, harmonizing the systems, optimizing the layout, downsizing the staff, strengthening the front line and innovating the mechanism), the pluralistic agricultural technology extension system at the grassroots level will be gradually constructed. This system should be based on national agricultural technology extension institutions and rural cooperative economic organizations, with wide participation of agricultural scientific research and teaching organizations and agriculture-related enterprises.

In 2008, the “*Decisions*” of the Third Plenary Session of the Seventeenth CPC Central Committee explicitly raised the requirements to strengthen capacity building of agricultural public service, realize innovation of management system, improve personnel quality, strive to improve public service institutions, such as town-level or regional agricultural technology extension institutions nationwide within 3 years, and gradually build village-level service stations.

In 2009, China launched the demonstration country program for reform and construction of agricultural technology extension system at the grassroots level by investing about RMB 800 million per year to promote the reform of agricultural technology system and the agricultural technology extension. In 2010, the state launched the engineering project of “infrastructure construction for town-level agricultural technology extension institutions” to build and improve the office facilities, training facilities and village service tools of the town-level agricultural technology extension institutions.

In 2012, Document No. 1 of the CPC Central Committee raised the requirements to comprehensively accelerate the innovation and extension of agricultural science and technology, enhance the agricultural technology

extension capacity, realize full coverage of “demonstration country program for reform and construction of agricultural technology extension system at the grassroots level” and “engineering project of infrastructure construction for town-level agricultural technology extension institutions”, and bring the agricultural technology extension institutions at all levels into full play.

III. Public agricultural technology extension institution has the irreplaceable position and role

(I) Agricultural technology extension system is the irreplaceable supplier of agricultural public technology service

The beneficiary of agricultural technology progress is the society, which has characteristics of public goods and very strong social-ecological effect, so agricultural technology is difficult to be marketed. This determines that the individual cost for the application of a large amount of agricultural technologies is higher than social cost, individual profit is less than social profit, and it is impossible to achieve optimal supply-demand balance only by means of market mechanism adjustment. In China, the household operation is characterized by small scale and discrete production, and the scale effects generated from many new agricultural technologies are insufficient to attract farmers to compete for the use of new technologies. At the same time, a large number of farmers went from rural areas to work in urban areas, and most farmers who engaged in agriculture are old people with low education level, so they are very weak in accepting new technologies. Thus it is very necessary for the agricultural technology personnel to provide these farmers with technical consultation, technical guidance and technical service free of charge. The objective of agricultural public service is to promote national grain safety, agricultural industry safety, agricultural product quality safety, agricultural ecological environment safety and so on. It has been explicitly defined that related agricultural technology extension services shall be provided by national agricultural technology extension institutions.

(II) Agricultural technology extension system is an indispensable science and technology support for development of modern agriculture

In China, agricultural development is more and more outstandingly restricted by the resources, the declining trend of farming area is inevitable, water resources are only 1/4 of the world average level, and the water and soil resources are disproportionately matched and dislocated. All these have to be addressed by science and technology progress. And agricultural technology extension system is the key to accelerate agricultural technology extension, promote science and technology progress, and thus to develop modern agriculture.

(III) Agricultural technology extension system is an indispensable significant force for the training of modern farmers

For a long time, the agricultural technology extension system at the grassroots level has made significant contribution to improving farmer ability in crop farming and aquaculture by making full use of its own advantages in network, human talents, technology, closeness to and understanding of farmers, and in

combination with the extension and application of new varieties and new technologies, and by means of opening agricultural technology consulting hotline, creating agricultural science and technology demonstration fields and demonstration households, and holding science and technology training of various types for farmers, such as technical training classes, farmer field schools, broadcasting and TV lectures, and field visit and assistance.

(IV) Agricultural technology extension system is an indispensable organization basis for the duty performance of the agricultural departments

The agricultural departments at all levels take significant responsibility to organize and guide agricultural production and comprehensively coordinate the economic work in rural areas. The economic work about agriculture and the rural areas shall be carried out by agricultural technology extension departments and agricultural technology extension personnel at the grassroots level. Agricultural technology extension teams at the grassroots level shall be positioned at the grassroots level of the rural areas and in the front line of agriculture, with the objective to be familiar with agriculture, understand the rural area, and timely communicate agricultural science and technology, rural area policies and market information to the field and farmers, and have timely understanding and feedback of the agricultural situations and opinions from farmers. It serves as the significant bridge and link between the CPC and government with the farmers.

IV. Main methods of technology extension

(I) Public sector driven extension model

Public-driven agricultural technology extension model is the top-down technology extension model, in which government will determine the extension objective and define the extension object and contents. The agricultural technologies to be extended shall be generally researched and developed by agricultural research personnel and shall be extended by the agricultural technology personnel organized by the government. The institutions and organizations shall be under direct leadership of agricultural department, and technology extension stations (centers) subordinate to agricultural department shall be responsible for organizing, managing and implementing agricultural technology extension. The government shall be responsible for macroeconomic guidance, developing management method, issuing corresponding guidance and incentive policies, determining the extension plan and mid- and long-term development plan, and determining the general objective, main tasks and work emphasis. They may be classified into national project and national guidance. The former includes the implementation proposal and the dedicated fund, for example, “exhibition of new varieties of agricultural crops”, “creation of high production of grain, cotton and oil”, “creation of standard garden for horticultural crops”, “soil testing and formula-based fertilization”, and “overall protection and control of crop diseases and pests” and so on. The latter includes only guidance opinions, without the dedicated fund, for example, “Technical Guidance Opinions on National Agricultural Technology Extension and Service Center”.

(II) Farmer-demand driven extension model

This is an agricultural technology extension model based on observing market economy and the present situation of agricultural development, highlighting the position of farmers in the application of technology, with the objective to resolve practical problems of farmers in production applications and agricultural industrialization. Set the extension topics according to the requirements of farmers, develop the extension plan, carry out the work according to the plan, make the evaluation, feed the evaluation results back to the next extension plan, infiltrate agricultural science and technology extension service into the agricultural production before, during and after the production, use the participative approach for technical trainings, and thus fully mobilize and motivate farmers. During the use of new technologies, the problems and detailed requirements will be fed back to the agricultural technology extension department, and will finally be taken into consideration by the relevant research institutions. After improvement, the above methods shall be fed back to farmers. Farmer field school (FFS) represents one type of this method. This model not only cultivates human talents in rural area, but also reduces the blindness in agricultural scientific research and extension and improves the extension efficiency.

V. Main extended technologies

(I) Extension of improved crop varieties

Increase effort to extend new varieties of multi-resistant crops with high yield and quality. Promote more than 1,000 new varieties of main crops per year, with annual change ratio of new varieties of 10%, the coverage rate of improved varieties above 95%, and the contribution ratio of varieties to the agricultural yield increase up to above 40%.

(II) Extension of cultivation technology

1. High-yield and high-efficiency cultivation technology of crops. The following technologies are mainly extended: rice seedling throwing, super rice, wheat precision and semi-precision seeding, delaying nitrogen fertilization, “One Increase (that is, increase the planting density) and Four Replacements (that is, replace the original varieties with the density-resistant varieties, replace the cross planting with plain planting, replace the extensive fertilization with formula-based fertilization, and replace the original manual planting with mechanized operation)” of corn, plastic film mulching and virus-free potato planting.

2. Light-type and high-efficiency cultivation technology of oil crops. The following technologies are mainly extended: technology of dense soybean cultivation in three narrow ditches on the ridge, dense soybean planting in narrow rows, little or no tillage and direct seeding of rapeseed, plastic film mulching for peanut, and summer planting of wheat stubbles.

3. Quality and high-efficiency cultivation technologies of cash crops. The following technologies are mainly extended: super-high-yielding cultivation and soilless seedling and transplanting of transgenic insect-resistant cotton, intensive seedling of vegetables, facility cultivation, and pest avoidance of horticultural crops.

(III) Extension of plant protection technology

1. Comprehensive prevention and control techniques against significant diseases and crop pests. The following technologies are mainly extended: emergency prevention and control and ecological control techniques against locust and beet webworm, as well as “two migratory” pests for the rice, “one spraying and three preventions” for the wheat, general field mouse killing, chemical prevention and control of grass pests, and green prevention and control of crop diseases and pests.

2. Safe and scientific pesticide use techniques. The following technologies are extended mainly: significant techniques on pesticide reduction, disease and pest control, substitution of highly toxic pesticides, pesticide use risk evaluation and so on.

3. Specialized overall prevention and control techniques. 64 thousand specialized organizations in overall prevention and control were established and specialized overall prevention and control was carried out in 440 million *mu* (1 *mu* = 1/15 hectare) fields in 2011, and specialized overall prevention and control coverage rate against diseases and pests of rice and wheat was up to 12%, and the prevention and control effect was improved by 5-10%.

(IV) Soil, fertilizer and water technology

1. Soil fertility and fertilizer cultivation technology. The following technologies are extended mainly: soil organic matter improvement technologies, such as straw decomposing and returning, planting with green manure, adding the application of commercial organic fertilizers.

2. Scientific fertilizer application technology. Technologies such as soil testing and formula-based fertilization are mainly extended.

3. Largely extend the agricultural water-saving technology, mainly promoting significant technologies such as integration of water and fertilizer, plastic film mulching for rainwater collection for soil moisture conservation.

VI. Achievements in agricultural technology extension

(I) National agricultural technology extension system is gradually improved

The agricultural technology extension system in China experienced certain fluctuation, but generally speaking, the institution has been gradually perfected and the conditions have been gradually improved. The agricultural technology extension institutions of central, provincial, city, county, and town levels have been built and agricultural technology extension system has been preliminarily formulated vertically and horizontally. The implementation of various kinds of significant projects has further improved the infrastructure and service means of the agricultural technology extension system; and the extension service capacity has been significantly improved.

(II) Extension effects of significant technologies are outstanding

1. Promotion of high-yield and high-quality varieties. In the last ten years, 1,459 varieties of main crops have been promoted for use after being tested and verified by national-level laboratories. The change ratio of

new varieties for main crops per year is 12%-13%, and the coverage rate of the improved varieties is above 90%. Very good effects have been achieved in the demonstration of improved varieties. Take the results of 2005 as an example, 1,427 new varieties of main crops were displayed, 331 new varieties were demonstrated and more than 1,000 field visits were organized in 30 provinces, autonomous regions and municipalities directly under the Central Government, which largely boosted the promotion of high-yield and high-quality varieties as well as their upgrading and updating.

2. Promotion of high-yield and high-efficiency cultivation technologies. With respect to the cultivation of grain crops, many technologies have been promoted, such as seedling throwing, dry raising seedling and thin planting, no-tillage cultivation for rice; precision and semi-precision seeding, plastic film mulching, delaying nitrogen fertilization and postponing the ageing, little or no tillage for wheat; plastic film mulching for corn; seeding against the stubbles, compact and high-yield cultivation of corn. According to the preliminary statistics, from the early 1980s till now, these technologies have been promoted and used in the fields of 6.24 billion *mu* accumulatively, realizing average yield growth of 47 kg per *mu*, saving the cost and increasing the benefit of RMB 90 per *mu*, totally increasing the crop yield of 292.3 billion kg and totally saving the cost and increasing the benefit of RMB more than 560.0 billion. With respect to the cultivation of cash crops, various high-yield, high-quality and high-efficiency cultivation technologies have been promoted, such as high-yield cultivation of cotton with plastic film mulching, high-yield cultivation of soybean, high-yield and quality-retaining cultivation of double-low rapeseed, plastic film mulching of peanut, new variety of oil sunflower hybrid and the supporting high-yield cultivation technology, high-yield and high-sugar cultivation of dry land sugarcane, seedling and transplanting of sugar beet in paper tube. Total area for promotion is about 3.0 billion *mu* and the realized net income is above RMB 120 billion. With respect to the cultivation of horticultural crops, the cultivation techniques represented by vegetable plastic film mulching have been widely used to improve the yield per unit by 30%-50%; the promotion of the supporting techniques for greenhouse vegetable moves forward and postpones the vegetable supply period by 30-40 days respectively, and significantly shortens the vegetable offseason in spring and winter; China's own sunlight greenhouse energy-saving cultivation technique has overcome the technical difficulty for the production of vegetables in spring and winter in northern China.

3. Promotion of scientific fertilizer application technologies. With the implementation of the projects of "rich-soil engineering", "precision agriculture" and "soil testing and formula-based fertilization", the agricultural technology departments in various places have ascertained the abundance or deficiency of soil nutrients, and determined the fertilization amount and strategy accordingly, and thus improved the utilization rate of fertilizers. For example, in the course of the project of "soil testing and formula-based fertilization" being implemented since 2005, RMB 2.75 billion from the central government finance had been invested to 1,861 project counties till 2008. In this context, soil testing and formula-based fertilization service was provided to 120 million farmers free of charge in 900 million *mu* fields every year, the fertilizer utilization rate was improved by more than 3%, and average annual benefit was increased by RMB 22.5 billion, thus resulting in significant economic, social and ecological benefits. Since the "Tenth Five-Year Plan" period, the agricultural technology departments at various levels have built a series of water-saving agricultural technology

demonstration zones for water-fertilizer integration, drip irrigation under mulch, drought combating and seedling preservation, rainwater collection and supplementary irrigation, mulching for water collection and soil moisture conservation, soil moisture measurement and water-saving irrigation of winter wheat, and soil reservoir construction. The agricultural technology departments at various levels have promoted the field water-saving technology in the area of 63.35 million *mu*, increased the grain yield about 3.27 billion kg and helped farmers to increase the income of about RMB 4.8 billion.

4. Promotion of biological disaster monitoring and control technologies. With respect to the disease and pest forecasting and report, the forecasting and report method and standard have been developed to make full use of modern information technology in order to accelerate information transmission. The accuracy ratios for the long-term, mid-term and short-term forecasting of significant diseases and pests have reached 85%, 90% and above 95% respectively. With respect to the prevention and control of significant diseases and pests, comprehensive supporting prevention and control method has been established by developing and integrating comprehensive prevention and control techniques for major diseases and pests, such as rice, wheat, cotton and vegetables, as well as for significant biological disasters, such as locusts and farmland rodents, and by coordinating the use of agricultural, physical, biological and chemical prevention and control measures. This has significantly improved the capability in plant protection, disaster prevention and reduction, continuously controlled the locusts which have caused disasters for thousands of years in the history, obviously weakened the trend of wheat stripe rust, significantly improved the monitoring and control level of rice plant hopper, and suppressed the outbreak of cotton bollworm.

(III) Capability of supervision according to the law is constantly improved

Multiple laws and regulations, such as *Law of the People's Republic of China on the Popularization of Agricultural Technology*, *Seed Law of the People's Republic of China*, and *Interim Provisions on Governing Crop Seed Production and Operation Management*, *Regulations on Plant Quarantine*, *Implementation Measures for the Regulations on Plant Quarantine*, *Regulations on the Management of Pesticides*, *Regulations on Safe Use of Pesticides* and *Measures for the Registration of Fertilizers* have been promulgated, which have laid the foundation for legal implementation of agricultural technology extension. At the same time, more than 200 national and industry standards have been completed, including *Rules for Agricultural Seed Testing*, *Rules of Field Testing for Crop Varietal Purity*, *Quality Standards for Crop Seeds*, *Rules for Investigation and Forecast of Main Crop Diseases and Insect Pests*, and various regulations on quarantine of plant and nursery stock, thus serving as a basis for the standardization of the agricultural production and management in China and for the improvement of market competitiveness of agricultural products worldwide.

(IV) International exchange and cooperation is under thriving development

Chinese Agricultural Technology Extension System is operated through exchange with foreign counterparts to actively broaden the channels and carry out extensive foreign cooperation and exchange, having achieved significant results. During recent 10 years, the System has organized and implemented international projects,

such as cotton and vegetable integrated pest management (IPM) project of the United Nations Food and Agriculture Organization (FAO), rapeseed and balanced fertilization project of the United Nations Development Programme (UNDP), and agricultural technology extension and seed bank project of World Bank (WB). It worked with The Sulphur Institute (TSI) to carry out cooperation project of soil testing and sulphur technology extension; organized and implemented multiple cooperation projects between countries, such as project for comprehensive control of cotton diseases and pests with the support of Centre for Agricultural Bioscience International (CABI), and the project of strengthening the building of agricultural technology extension system in China with the support of Japan. It has organized and implemented the monitoring and control of rice plant hoppers in Sino-Kazakhstan and Sino-Korean border areas. According to estimates, the System has implemented more than 30 assistance projects of various kinds with project funds of more than USD 80. million. In addition, more than 200 technical training and survey teams were organized by various means with the participation of 2,100 person-times, which has significantly improved the agricultural technology management level in China. Every year, more than 50 foreign agricultural visiting teams are received, 28 classes of agricultural technology extension of various kinds were successfully held for 528 person-times from Africa, ASEAN and Shanghai Cooperation Organization (SCO) member countries. On the other hand, Chinese experts were sent to Ethiopia, Mali and other 10 countries in Africa to provide technical training and guidance. All these collaborations have made an important contribution to the human resource building in developing countries in Africa and ASEAN countries.

VII. Prospect for agricultural technology extension

The Chinese government attaches constant emphasis on the development of agricultural technology extension system, and will do well in further defining its public-interest functions, guaranteeing the work funds, building stable and high-efficiency agricultural technology extension system and innovating the extension mechanism.

(I) Strengthen the institution building and ensure effective performance of the duties

1. Define the tasks for the public-interest functions. Further strengthen the public-interest positioning of the town-level or regional agricultural technology extension institutions, segment the public-interest functions into the tasks, define and assign the responsibilities and requirements to every agricultural technology extension institution and every agricultural technology personnel.

2. Scientific approach for staffing administration. Based on the rule of being streamlined, high-efficient and reasonable, staffing structure for the town-level or regional public-interest agricultural technology extension institutions is implemented after scientific calculation and reasonable appraisal, to ensure effective performance of their public-interest functions.

3. Innovate the management system. Strengthen the management and guidance of the county-level agricultural departments on the agricultural technology extension systems at the grassroots level. For public-interest agricultural technology extension institutions, explicitly define the guidance responsibilities of the county-level agricultural departments in the development, implementation and work evaluation of the plan for

agricultural technology extension, fully heed the opinions of competent county-level business departments with regard to the deployment, evaluation and promotion of personnel, and practicably resolve the problems in separation of the management on personnel and things resulting from the barriers between different departments and regions.

(II) Strengthen team building and improve the personnel quality

1. Gradually implement the access system of the agricultural technology personnel. The agricultural technology personnel in the technology extension institutions for public interests shall have the corresponding academic diplomas, or shall receive the training and examination held by the people's government above the county level, to achieve the corresponding technological level before participating in the position competition.

2. Encourage and support university graduates to go to the rural areas and support the farmers. Guide and encourage university students in agriculture-related majors to serve the agricultural technology extension system at the grassroots level, implement agricultural technology extension projects, guide the operation of agricultural experiment demonstration bases, so as to infuse new vital forces into the agricultural technology extension system at the grassroots level.

(III) Innovate the extension operation mechanism, and energize the agricultural technology extension

1. Comprehensively promote the responsibility system of agricultural technology extension. Reasonably determine the responsibilities linked to respective positions, define the duties, scope, object and contents of the work for the working personnel, and quantify the work indexes and task requirements.

2. Build and improve the performance evaluation mechanism. Promote the performance evaluation mechanism with the participation of farmers, the competent county-level agricultural department and the town government, take the working capacity of agricultural technology personnel and their actual performance of promoting agricultural technologies in the rural areas as the main evaluation indexes, and tie the evaluation results with the salary, reward and promotion of agricultural technology personnel.

3. Innovate the ways and means for agricultural technology extension. Comprehensively promote the accountability system of extension personnel to farmers; promote the information-based service of agricultural technology extension; facilitate the spill-over effect and demonstration role of high-yield demonstration regions and agricultural testing and demonstration bases; promote effective approaches such as "scientific and technological special envoy" that combines agricultural research and teaching with practical agricultural industry; adopt tendering and bidding system, government ordering, and contracting to explore multiple realization tools of agricultural public service.

(IV) Strengthen the condition building, and enhance public service capacity

1. Strengthen the building of the facilities and conditions for the town-level or zonal agricultural technology extension institutions, focusing on the building of instruments and devices, office conditions, traffic

tools and business houses to equip the town-level or zonal agricultural technology extension institutions with working places, service means as well as the tools to go down to the rural areas.

2. Strengthen the building of test demonstration bases. Build demonstration bases focusing on one main industry that allows multiple demonstration purposes, carry out the introduction, testing, demonstration and technical training of new varieties, new technologies and new products.

3. Explore the model of building village-level service stations. Make use of the service facilities in the existing office places and the Specialized Farmers' Cooperatives, adopt the means of private operation with public support, supply of technology and agricultural materials, and open operation, to gradually build village-level service stations and explore service mechanism for farmers.