Cooperation of agricultural science and technology between Xinjiang and Central Asian countries

Xinjiang Academy of Agricultural Sciences

1. Development of agricultural science and technology in Xinjiang

(1)The main achievement of agricultural science and technology in Xinjiang

There are 67 agricultural research institutions, 11,000 extension workers for scientific research in Xinjiang. As 250, 79 million RMB has been raised in the area of agricultural science in 2007, the basic conditions for research have significantly improved and seven key laboratories including Key Laboratory of Crop Cell Engineering, Xinjiang Laboratory of Animal Biotechnology and Xinjiang Laboratory of Grassland and Ecological Resources, three engineering research centers including National Cotton Engineering Research Center as well as raw material bases of cotton, sugar-beet and oil have been set up.

Since the Tenth Five-Year Plan, agricultural scientific researches in Xinjiang have won more than 100 national and provincial-level awards for scientific and technological progress, 11 of which are first and second prizes of national scientific and technological progress, 52 of which are first and second prizes of scientific and technological progress in autonomous area. 68 new crop varieties and five plant varieties are applied to be protected. This shows that agricultural science and technology in Xinjiang are among the national advanced level in some high-tech areas.

Contribution rate of agricultural science and technology has been increased from 35% at the end of “Ninth Five-Year” to 45% at the end of “Tenth Five-Year”.

Agricultural science and technology effectively supports four agricultural products bases of “grain, cotton, fruit, livestock” in Xinjiang and updates for four or five times in nearly 50 years many varieties including grain, cotton and oil crops. Besides, rate of improved variety of cattle reaches 60%, sheep 69%, goat 67% and pig above 90%. Per unit area yield of main crops has been significantly increased. For examples, Per unit area yield of wheat reaches 338 kg/ acre, corn 573 kg/ acre, cotton 121 kg/ acre and oil crop kg/ acre, which are respectively increased by 222%,278%, 314% and 223% compared to those in 1980.

The output value of animal husbandry and fishery reaches 117.7billion, an increase of 714% than that in 1980 while per capital net income of farmers and herdsmen reaches 3,500 yuan, an increase of 413% than that in 1980.

(2) The development of main subjects of agricultural science and technology in Xinjiang

In breeding area, conventional technologies such as system selection, hybrid breeding, chemical mutagenesis and heterosis utilization have transferred to modern biological technologies including molecular marker, transgenic technology, gene

technology and molecular design breeding technique. In addition, improvement of plants and animals as a whole at single-level has developed to multi-level improvement including the molecules, cells, tissues and individuals. As integration of conventional and modern biological technologies has been a primary means to improve the yield and quality of crops, cultivation of new varieties of plants and animals is on the top of the nation.

In crop cultivation areas, with single technological application developing to integrated technology system suitable for the technical assembly, high yield, high efficiency, water conservation, ecology, and security are goals to achieve. Standardized cultivation techniques are widely used in production. Yield per unit of main crops is in a leading position.

In the water-saving agriculture and soil management area, with the improvement of technology and independent research in ancillary equipment, the application scope of under-mulch-drip water-saving irrigation has been expanded. Besides, many new micro-irrigation technologies have made great achievement in research and application among the top of the world such as Under-film drip irrigation, water irrigation, drip irrigation as well as mobile under-mulch-Drip irrigation. Soil management technology has entered into a new phase of technology testing and application featuring in intelligent control of water and fertilizer.

In the area of industrialized agriculture, the standardized industrialized agriculture equipment and facilitation have been produced suitable for the different climatic conditions in different areas of Xinjiang and applied in a wide range of Xinjiang. It has set up pollution-free production technology system and plant vegetable successfully even in desert with no soil or less soil. Its overall level has reached the international advanced level.

In the area of animal and plant protection, integrated control for pest insects under the extremely dry ecological environment in Xinjiang has been in a leading position and the integrated control system for pest insects has been established and some relevant technical regulations have been formulated, which gives a full play to field ecosystem and crop's natural control for pest insects. Moreover, animal vaccine has been into bio-technology stage where it adopts molecular biology, studies new vaccines including subunit vaccine and genetic engineering vaccine, develops biological diagnosis chip, genetic engineering drugs and vaccines and obtains proprietary intellectual property rights of some new drugs.

In the area of agricultural machinery, research and development and application of agricultural machinery equipment in Xinjiang is at the domestically advanced level. Total power of agricultural machinery reaches 11.6471 million kilowatts; the number of equipment for harvesting is 5,500 and the total harvesting rate of corn machines is 30%. What's more, advanced mechanical technologies and agriculture equipment have been put into use such as conservation tillage, water-saving irrigation, and mechanical harvesting technology for corn, cotton, tomato, sugar beet and potatoes.

(3) The development direction of agricultural science and technology in Xinjiang

According to the requirements of "high-yield, high quality, high efficiency, ecological safety", centering key technologies of modern seed industry, agricultural facilities, agricultural products, water-saving agriculture and Prevention and control of animal and plant disease, it establishes a agricultural production system and modern agricultural technology service system integrated traditional, conventional and modern technologies oriented by the high-tech technology to improve agricultural productivity, soil fertility, make use of agricultural resources and reach the goal of energy-saving and high efficiency and environmental protection.

2. Cooperation of Agriculture science and technology between Xinjiang and Central Asia.

As the rich area of natural resource and arid and semi-arid agro-ecological zone, Xinjiang and central Asia countries which includes Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan locate in the hinterland of the Eurasian Continent with a vast land, characterized by rich resources in light, heat, land and agricultural germplasm, high potential demand for agricultural science and technology as well as complementarities. As Xinjiang borders Kazakhstan, Tajikistan and Kyrgyzstan, it plays an important role of agricultural production in this area and has the broad prospects for cooperation. However, cooperation of them is still in the relatively lagging initial stage, featuring in small scope range of cooperation, low level, poor conditions of both soft and hard environment and low benefits, which makes an obvious contrast to the wish to cooperate between two parties and the immerse potential, so it needs to be improved and promoted.

(1)Exchanges of scientific and technological personnel

The number of technological and economic delegations between Xinjiang and Central Asian republics such as Kazakhstan, Uzbekistan was 2,251 in 1990, 3262 in 1992 and increasingly up to 15,169 in 1993, which is 6.7 times and 4.6 times respectively than that in 1990 and 1992. In 1993, the number of technical and managerial staff sent to Central Asia at government's expense was 24,188, with an increase of 59% than that in 1992. Since 2000, the increasing number of delegations has been sent to Central Asia to exchange science and technology. For example, the number of exchanges between talents in Xinjiang Academy of Agricultural Sciences and Central Asian countries is 22 times involving 82 people, among which, 12 delegations are invited involving 40 people while 10 delegations are sent abroad involving 42 people. (See table 1)

Table 1 2005-2009 Exchange of talents between Xinjiang Academy of Agricultural Sciences and the Central Asian countries

Year	The introduction of delegations (batch)	Sent delegations (batch)
(2005)	2 batches 9 people	1 batch 8 people

(2006)	4 batches of 11 people	2 batches 10 people
(2007)	2 batches 8 peple	1 batch 1 people
(2008)	0	4 batches of 7 people
(2009)	4 batches 12 people	2 batches 16 people
Total	12 batches 40 people	10 batches 42 people

(2) The technological and academic exchanges

The agricultural technological and academic exchange between Xinjiang and Central Asian countries is an important stage to conduct talents exchanges, project cooperation and introduction of results. Since 2000, various types of exchanges including academic exchanges, seminars and training have been 100 times. Bilateral and multi-lateral exchanges of results, resource and technology as well as a number of projects are promoted by technological and academic exchanges.

(3) Project cooperation

Project cooperation of agricultural technology deepens and upgrades the talents and academic exchanges between Xinjiang and Central Asian countries, which play an important role to raise the level of cooperation. In recent years, projects in science and technology gradually increase on the whole, among which, Xinjiang Academy of Agricultural Sciences have conducted six projects supported by the Ministry of Agriculture and Ministry of Science during 2005-2009, with more than 1200 million funds (Table 2).

Table 2 2005-2009 Projects of cooperation between Xinjiang Academy of Agricultural Science and Technology and Central Asian countries

Project	Country for cooperation	Project period	Executable unit	Supervision	The amount of funds (Million)
Industrialized breeding Bracon and Technology of field application in arid cotton areas	Uzbekistan	2005-2007	Institute of Plant Protection	Ministry of Science and Technology	260
Natural resources exploitation and environmenal protection in Kyrgyzstan	Kyrgyzstan	2008-2009	Institute of Agricultural Economics	Ministry of Science and Technology	40
Investigation on	Kyrgyzs		Institute of	Ministry of	95

water resource of Tarim River	tan	2009-2010	Agricultural Economics	Science and Technology	
Collection and innovation of Foreign germplasm c	Five Central Asian countries	2009-2010	Institute of Crop Germplasm Resources	Ministry of Agriculture	30
Joint-investigation and rational planning of water resources upper reach of Aksu River	Kyrgyzstan	2010-2012	Institute of Agricultural Economics	Ministry of Science and Technology	537
Output and demonstration of engineering technology of efficient agricultural facilities.	Kazakhstan	2009-2011	Institute of Agricultural Machinery	Ministry of Agriculture	300

(4) Problems in cooperation

Problems in cooperation between Xinjiang Agricultural Science and Technology Cooperation and Central Asian countries are reflected in the following five aspects:

(i) It is lack of government guidance and overall planning. As a gradual long-term project, cooperation of agricultural science and technology requires overall planning and step-by-step implementation. However, cooperation between Xinjiang and Central Asian countries has neither been strengthened nor combined their advantages to conduct complementary, perspective and operational cooperation. The majority cooperation projects just involve self-arrangement and personnel exchange, which is not conducive for the cooperation.

(ii) It has difficulty in communication between scientific and technical personnel and small size and scope of cooperation with low level. Firstly, difficulty in communication results of official languages of two parties including Chinese, Russian Kazakh and other languages. Secondly, the relatively small scale of cooperation is due to personnel and academic exchange involving fewer people, cooperation limited in particular technology, products and germplasm rather than cooperation of a set of technology and equipment and lack in in-depth scientific and technological cooperation projects.

(□) It is lack of funds to support agricultural research, development and cooperation. As the limited agricultural science and technology funds in Central Asian countries, cooperation of agricultural science and technology is mainly China-based one-way cooperation. However, founds investment of Xinjiang and China to cooperation of agricultural science and technology with Central Asian countries is relatively in shortage, resulting in low-level cooperation of agricultural science and technology between Xinjiang and Central Asian countries.

(□)It is lack of the cooperation information of agricultural science and technology and the information is not complete, systematic and effective. Scientific and technical personnel of china fail to get the complete and systematic agricultural science and technology information of central Asian countries , which fails to provide information support for the cooperation and affects the bilateral and multilateral cooperation to some degree. Meanwhile, there is a shortage of information collection, collation and analysis in Xinjiang towards agricultural science and technology information of Central Asian countries.

(□) Policies of cooperation haven't been perfected. As Central Asian countries are in transition stages of independence and economic reform for the last ten years, political situation is unstable and legal system is still in construction and the environment and policies for cooperation is imperfect, so cooperation of two parties have greatly affected. Besides, there is lack of incentive policies and specific guidelines for management in Xinjiang.

3 The prospect and priority areas of agricultural science and technology cooperation between Xinjiang and Central Asian countries.

(1) The advantages and potential of science and technology cooperation

As Xinjiang and Central Asian countries are similar in natural ecological environment with generality and complementary nature in development and demand of science and technology despite difference in conditions, level and infrastructure of agricultural production, they boast a broad prospect with obvious advantages for cooperation of agricultural science and technology.

(□) long-term friendship and The Shanghai Cooperation Organization as the mechanism guarantee between China and Central Asian countries create a solid foundation for the cooperation of agricultural science and technology. Adherence to the principle of "A good-neighborly relationship and partnership with its neighbors" and diplomatic policy of "bringing harmony, security and win-win profits to the neighbors", China has maintained long-term friendship with Central Asian countries. Meanwhile, the win-win cooperation between China or Xinjiang and Central Asian countries has been fully reflected in the framework of The Shanghai Cooperation Organization, political trust and economic exchanges have been strengthened , so carrying out cooperation in agricultural science and technology between Xinjiang and central Asian countries under this framework and mechanism has unique advantages and conditions.

(□) With rapid economic development and constantly improved agricultural technology, China have enough founds and advanced technology to carry out cooperation of agricultural science and technology. As Xinjiang is on the top of agricultural science and technology in arid areas, it will have more obvious advantage in science and technology and funds promoted by the strategy of "Development of the West Regions" and "Paired-up Assistance to Xinjiang". In addition, as Xinjiang and Central Asian countries are in the arid area of the hinterland of the Eurasian Continent, they are similar and complementary in agricultural resources, production technology and application, so they boast economic, resource, and technological basis for in-depth cooperation.

(□) Xinjiang and Central Asia countries are similar and complementary in the type of agricultural production, environment and demand for science and technology. For example, Central Asian countries have advantages in gathering and cultivating crop varieties, breeding, controlling pests, livestock and poultry breeding and raising, grassland protection and utilization as well as agricultural mechanization while Xinjiang has striking advantages in selection and breeing advanced varieties, advanced cultivation techniques, water-saving irrigation technology and equipment, agricultural facilities, biological control, transformation and ecological management of low-yielding farmland, agricultural information technology as well as pesticides and fertilizers, so two parities have great potential to cooperate.

(□) geopolitical, cultural advantages of Xinjiang and Central Asia countries create unique conditions for the cooperation in agricultural science and technology. Xinjiang are linked with Central Asian countries by mountains, rivers, roads, railways and pipelines with a length of 3,288 km borderline and 12 ports of national first class. Moreover, Xin Jiang and Central Asia countries have the similar characteristics in many aspects including ethnic composition, culture, language, customs, religion and social change, so they have a long-term cultural identity and similarities in economic, scientific and social structures, which is conducive to carry out and promote the cooperation of agricultural science and technology in the whole area.

3 The crucial area of scientific and technological cooperation

(1) Advantages and potential for cooperation

(i)The exchange of germplasm and species, which mainly includes the exchange of food crops, specialty crops, fruit and fine species of livestock germplasm, fine species (livestock species) as well as the exchange of unique plant germplasm resources.

(ii)The popularity of high yielding cultivation and breeding techniques, which mainly includes the communication and popularity of the high-yielding and high-efficiency cultivation techniques of crops, the three-dimensional techniques of agro-forestry planting, the high-yielding cultivation techniques of edible mushrooms and the high-efficiency breeding techniques of livestock raising.

(iii) The package and applications of the plant protection technology. On the basis

of full use of their own new plant protection technology, the integrated pest management technology for the major crops, biological control of the biological agents, and the extract matching technology of fungi should be emphatically carried out.

(iv) The water-saving irrigation and soil improvement techniques. This mainly includes the popularity and application of the modern techniques such as the conventional irrigation methods adapting to different crops and growing conditions, the self-pressure sprinkler irrigation technology, the subsurface irrigation technology and equipment, etc. The cooperation and communication should emphatically developed in the following aspects: the technology of improvement of medium- and low-yield fields, the geographic information technology of soil nutrient management, the high-yield and high-quality technology by soil fertilizing, the soil ammonia fertilizer technology, the production and application technology of the crop-specific fertilizer, the integrated technology for the improvement of acid-base soil, the artificial technology for the improvement of decertified land, and so on.

(2) **Crucial area of cooperation**

(i). The application and popularity of agricultural machinery, which mainly includes machines for cotton harvest and clean, machines used for the pest and disease control which adapt to different planting characteristics of crops agricultural production, machines for forage harvesting, precision planting, fertilizing, cultivators, and transportation, etc.

(ii The greenhouse agricultural technology, which is mainly consisted of the integrated agricultural technology system including the standardized greenhouse, greenhouse construction technology, production techniques of new materials for the greenhouse agriculture, the Automatic control of light, temperature, moisture, gas, fertilizer in the greenhouse, the exclusive strains adapting to the development of the greenhouse agriculture, cultivation techniques, etc.

(iii)The application of the resource management and the planning technology, which mainly includes the communication and cooperation in terms of the scientific management, efficient use and rational development of the water, soil, grassland, forest resources in the two sides and the interregional areas.

4 Measures to ensure the scientific and technical cooperation

(1) Within the framework of the Shanghai Cooperation Organization, the standing institutions and mechanisms should be established in Xinjiang and the countries in Central Asia for their development of agricultural science and technology cooperation and exchange in purpose of strengthening the organization and coordination in agricultural science cooperation, as well as preparing the bilateral and

multilateral cooperation in agricultural science in an overall plan under the unified leadership and implement, so as to strengthen the bilateral and multilateral cooperation in agricultural science and technology and promote the agricultural cooperation between the national governments to a higher level.

(2) All the countries should make policies to strengthen the agricultural technology cooperation and encourage Xinjiang of China to cooperate in the full range with Central Asian countries with regard to the agricultural technology. They should expedite the formulation of the plan of agricultural science and technology exchange and cooperation and of the related support policies and measures, so as to actively encourage and support the communication and assistance of the agricultural experts of both sides. They also should develop the agricultural science and technology exchange and cooperation in an all-directional, multi-layer and multi-range and diversified pattern, so that it can create a favorable environment for promotion the bilateral and multilateral cooperation in agricultural science and technology in an all-round way.

(3) China should increase the supports to the agricultural science and technology of the Central Asian countries, increase the amount of the scientific and technical assistance funding and establish the integrated agricultural technology demonstration bases in the Central Asian countries. By fully use of the channels of cooperation in agricultural science and technology established between China/ Xinjiang and Central Asian countries, China should actively create the special fund for agricultural science and technology cooperation in the Central Asian countries and increase the support as well as the amount of aid funds to the Central Asian countries in the agricultural science and technology projects. Through diversified means, such as bidding, commissioning, cooperative research, Xinjiang may encourage and attract the scientific research institutions, enterprises or experts of the both sides to participate in research projects; at the same time, the agricultural cooperation research center, agricultural science and technology enterprises and comprehensive demonstration base of scientific and technological cooperation between Xinjiang and Central Asian countries can be gradually established, so that it can promote in-depth development of the bilateral cooperation in agricultural science and technology.

(4) It should establish a mechanism of information-sharing and mechanism of mutual trust and benefit to strengthen the agricultural production and technology information collection, screening and analysis of both sides, especially in agricultural production structure, industrial layout, productivity and the construction of the information platform in technology development orientation, advantages and demands. It should fully use of the information network technology to effectively link the two sides' scientific institutions, agricultural research institutes, agricultural production and trade enterprises, and formulate the information sharing mechanism, so that they could play their respective advantages and improve the systematicness, accuracy and timeliness of the agricultural information. At the same time, it should ensure the mutual benefit in the process of the agricultural science and technology cooperation, enhance trust and identity between the two sides during the cooperation in agricultural science and technology in purpose of building a mechanism of

mutual-trust and mutual-benefit in the cooperation in agricultural science and technology and promoting the stable and sound development of the cooperation in agricultural science and technology.

(5) It should establish the long-term mechanism for the development of agricultural technology and the exchange of personnel. By using of their existing units, such as the agricultural research and teaching units, and the science and technology cooperation projects and personnel exchanges, it should maintain and expand the scale of agricultural R & D personnel exchanges, and enhance the range and level of project cooperation. Besides, it could actively seek the cooperation in agricultural science and technology projects and the exchange of technology by taking full advantage of the platforms as the business negotiation conference, the exhibitions and the trade fairs held by the both sides, so as to establish the long-term mechanism of the cooperation between units as well as experts.

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