Problems of Agricultural Technological Innovation in China and Countermeasures

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Abstract Major problems of agricultural technological innovation in China were summarized as below: first, poor agricultural science and technology system; second, deficient technological promotion system; third, shortage of agricultural professionals; fourth, serious shortage of science and technology input. In view of these problems, the following suggestions were given to improve the innovation of agricultural technology in China. (1) Restructuring agricultural research institutes, establishing cooperative innovation centers, improving agricultural technological innovation system; (2) Specifying the direction of research projects, improving scientific research level of technicians, so as to improve the agricultural technological innovation capacity; (3) Improving promotion and service stations in towns, organizing technological service teams of agricultural universities and colleges, establishing agricultural technological promotion systems; (4) Increasing input in agricultural technological innovation by attracting government input, enterprise investment and other financial support; (5) Cultivating more talents of agricultural technology, training leading agricultural technicians, grassroots agricultural service staff and practical talents.

Key words Technological innovation, Scientific research capacity, Promotion system, Financial input, Talent cultivation

Agricultural technological innovation is the fundamental driving force of agricultural and rural economic development. In recent years, agricultural researches have achieved remarkable fruits, promotion and application of the scientific research fruits have been greatly improved. However, contribution rate of agricultural scientific and technological progress is only 48% and the transformation rate of agricultural scientific and technological research fruits is 30%, while that of developed countries is 35% higher [1]. Such a huge gap has attracted the attention of agricultural departments and experts, and has become a new topic of the agricultural researches. In fact, poor agricultural technological innovation and application has seriously restricted social and economic development of China rural areas, thus the authors on the basis of analyzing major problems of the agricultural technological innovation in China proposed corresponding suggestions.

1 Major problems of agricultural technological innovation in China

1.1 Poor agricultural science and technology system In China, agricultural scientific research institutes are generally established according to administrative decrees and are subordinate to administrative management. Such a management system has at least four deficiencies. First, the gap between administrative department and discipline results in waste of scientific and technological resources, restrictions on the promotion and application of agricultural research fruits, and also discrepancy between research and agricultural production[2]. Second, scientific research institutes fail to complement each other's advantages. Agricultural enterprises are always operated in closed systems or certain administrative regions, and they fail to complement each other' advantages. Third, research programs are always organized without overall planning. Because research programs are generally arranged in certain administrative regions, there is hardly any national planning or overall consideration. Fourth, there is no effective incentive mechanism. Research staff pays more attention to application of research programs for applying academic titles or obtaining profits, but always neglects the promotion of research fruits, which directly leads to the low transformation rate of scientific research fruits.

1.2 Deficient technological promotion system Promotion of agricultural scientific and technological research fruits has failed to attract due attention, in addition, there are still problems in the construction of promotion system but no mature management experience. As a result, the transformation rate of agricultural research fruits is extremely low and has the following manifestations. First, shortage of grassroots promotion agencies of agricultural technology. Grassroots technological promotion agencies refer to county-level and town-level agricultural agencies (agricultural scientific department in counties, agricultural scientific station in towns), but both of them in China perform practically no function, thus the application and promotion of agricultural scientific research fruits is restricted. Second, lack of coordination between agricultural colleges and scientific research institutes. Functions and responsibilities of colleges and institutes are not clearly defined, especially agricultural colleges pay more attention to application of research programs and theoretical research, and the research funds are always limited, thus they are not enthusiastic about the application and promotion of research fruits. Therefore, the transformation rate of scientific research fruits is low. Third, poor quality of agricultural science and technology promotion staff. Poor organization capacity and experience of grassroots promotion staff, out-of-date

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concepts and confused work ideas[3] are all restrictions for the promotion and application of scientific research fruits.

1.3 Shortage of agricultural professionals Cultivation of agricultural talents in China is faced with acute structural imbalance. On the one hand, "relative surplus" of agricultural talents. For example, there are more than 40 agricultural universities and colleges in China where a great number of agricultural talents are cultivated. But only a few of these graduates are willing to work in rural areas where they are badly needed, the others always find jobs irrelevant to their majors in cities. As a result, the contradiction between unsatisfied rural needs and surplus talents in cities is becoming acute, and leads to the "relative surplus" of agricultural talents. On the other hand, serious shortage of high-quality agricultural talents. China is in want of high-quality agricultural talents for pioneering researches, practical researches, international-oriented and inter-disciplinary talents, and also talents of newly-emerging subjects and weak subjects, which also holds the agricultural scientific research back from the high-level development.

1.4 Serious shortage of science and technology input In recent years, agricultural scientific and technological development in China has mainly depended on government support, and preferences have always been given to developmental research programs of agricultural enterprises. In fact, the limited funds fail to meet agricultural scientific and technological development needs, and account for only a small ratio of the total government financial expense. Moreover, the funds are unevenly distributed in agricultural sectors, specifically, more funds are put in grain production, but an extremely small ratio in animal husbandry and fishery researches[3]. Due to the above-mentioned reasons and also insufficient agricultural science and technology reserves, agricultural application researches and scientific development in China are in bad need of funds. In addition, a diversified agricultural research development and input system has not been established yet, large- and middle-size agricultural enterprises and financial systems have not given due support.

2 Suggestions for the agricultural technological innovation

2.1 Improving agricultural technological innovation system

2.1.1 Restructuring agricultural research institutes. Agricultural technological innovation is to provide effective technical support for the optimization and upgrading of agricultural structure, and an innovation system suited to the greatly-improved comprehensive production capacity of agriculture[4]. In terms of management, a two-level management system is needed. First, central agricultural scientific research agencies consist of comprehensive agricultural research institutes of the Ministry of Agriculture, key agricultural universities and colleges, agricultural research institutes of Chinese Academy of Sciences. Second, provincial agricultural research agencies consist of provincial agricultural research institutes, local agricultural colleges. For counties and towns, research institutes are not set, but only agricultural technological promotion departments and stations are established to cooperate with scientific research institutes for building demonstration bases and promoting scientific research fruits. Such a management system avoids the resource waste caused by scattered and repeated scientific research institutes.

2.1.2 Establishing cooperative innovation centers. Scientific research institutes should break boundaries among departments, regions and disciplines, and cooperate with each other to build innovation centers[5]. By innovating the cooperation mechanism of agricultural education, production and research, and considering actual conditions and needs of different regions, more practical agricultural researches should be launched. Decision-making power of the innovation centers should be enhanced, and the principle of integrating scientific research and promotion and application must be followed. Furthermore, agricultural technological innovation has to meet needs of agricultural production, and transformation, promotion and application of agricultural scientific research fruits should be further promoted by means of demonstration tests or other forms.

2.1.3 Innovating scientific research and development mechanism. In terms of project establishment, industrial development should be taken as the orientation, directed authorization and independent selection of a subject, stable support and moderate competition should be combined to guarantee quality of the project. Agricultural enterprises are encouraged to take charge of national or regional key scientific research projects, so as to enhance their independent innovation capacity and develop newly-emerging agricultural industries. In terms of project evaluation, project classification and scientific assessment are necessary, and more efforts should be devoted in settling problems related to agriculture and rural areas. In terms of incentive, research staff with outstanding achievements should be awarded. Favorable living and working environment as well as preferential policies are all necessary to support agricultural technological innovation[6].

2.2 Improving agricultural technological innovation system

2.2.1 Specifying the direction of research projects. Agricultural scientific research capacity is the foundation of agricultural scientific research development, and a key task of improving agricultural scientific research capacity is to establish projects. For agricultural scientific research institutes, projects have to be designed reasonably from the perspective of agricultural economy development, and fundamental, pioneering and practical agricultural researches have to be highlighted. In terms of fundamental researches, more efforts should be devoted in innovating major basic theories and methods, for example, agricultural biological gene regulation, high-efficiency utilization of farmland resources, biological safety and safety of agricultural products. In terms of pioneering researches, independent innovation in such fields as agricultural biotechnology, agricultural information, advanced manufacturing technology and precision agriculture has to be highlighted. In terms of practical technology research, scientific research fruits should be able to meet needs of peasants, and more attention

should be paid to cultivation of improved varieties, agricultural machinery, prevention and control of diseases, new fertilizers and agricultural chemicals, water-saving irrigation, processing, storage and transportation of agricultural products, livelihood of rural residents[7-8].

2.2.2 Improving quality of technicians. First, the cooperation among agricultural colleges, research institutes and enterprises should be enhanced. The former two have to establish their projects according to needs of agricultural production and organize agricultural enterprises to join the researches. Second, agricultural colleges and research institutes have to provide favorable research environment for their staff, encourage them to establish projects and promote research fruits, so as to improve agricultural technological innovation capacity in an all-around way. Third, demonstration bases should be built, because demonstration is a key section for the promotion of scientific research fruits. Agricultural colleges and research institutes can build their demonstration bases in counties and towns, which can not only promote the transformation of scientific research fruits, but also cultivate more professionals.

2.3 Establishing and improving agricultural technological promotion system

2.3.1 Improving promotion and service stations in towns. It is a key for the transformation of agricultural research fruits to fully develop the role of grassroots agricultural service stations. By establishing promotion and service stations in towns, agricultural colleges and research institutes will know peasants' needs timely, help them settle problems directly. Therefore, the management system for town-level agricultural service agencies has to be improved, main functions of these agencies should be developed fully, nonprofit grassroots promotion services should be arranged, such as promotion of agricultural technology, prevention and control of animal epidemic, and improvement of agricultural product[9-10]. All of the above-mentioned services aim at settling problems that peasants possibly encounter in their production and life.

2.3.2 Organizing technological service teams of agricultural universities and colleges. To integrate scientific research, education, and promotion of research fruits, agricultural colleges may borrow successful experience of developed countries. For example, professors or researchers take charge of education and promotion, the Ministry of Agriculture sets a management and coordination agency for allocating funds for the scientific research, education and promotion of research fruits in all provinces[11]. Agricultural colleges should also devote more in promotion of agricultural technology, research and teaching staff should participate in grassroots agricultural technological services by organizing training courses, innovating and promoting technologies.

2.3.3 Establishing new social service organizations. County and town government should organize professional cooperatives, supply and marketing cooperatives, professional and technological cooperation, large- and middle-size agricultural enterprises, encourage them to provide peasants before-production, in-production and after-production services.

2.3.4 Establishing cooperation and innovation centers. Application and promotion of agricultural research fruits is a key for the transformation of agricultural research fruits, and also the significance of realizing value of these fruits. Scientific research institutes of all levels should break through the current administrative-management-based application mode of agricultural research fruits, enhance regional cooperation, and improve the cooperative and innovative agricultural promotion system. According to the layouts of regional agricultural industries, and promotion and service needs of characteristic industrial and technological areas, cooperation and innovation centers should be established[4]. Agricultural colleges and research institutes should fully play their leading role in organizing agricultural enterprises for the promotion of research fruits, enhancing cooperation of all parties, settling technical problems in agricultural production, improving the promotion of agricultural technology and transformation of agricultural research fruits.

2.4 Increasing input in agricultural technological innovation

2.4.1 Government input. Financial fund is the economic base of agricultural technological innovation, government of all levels should adopt effective measures by arranging budgets, increasing agricultural research funds (financial input in agricultural technology should be much higher than increase of regular revenues), so as to improve ratio of agricultural research input to added value of agriculture, allocate reasonable input for the scientific research and promotion of research fruits, and guarantee the transformation of scientific research fruits[12].

2.4.2 Leading enterprise input. Leading agricultural enterprises should invest according to their actual conditions and fruits of pioneering researches, dominant role of enterprises should be highlighted, technological research and development and transformation projects should be optimized. Enterprise scientific research activities should be organized for obtaining enterprise investment, sci-tech enterprises of various economic sectors should be developed, so scientific research subjects will become diverse, application of agricultural research fruits will be promoted, and industrialization of agricultural research fruits will be achieved.

2.4.3 Using foreign investment. Agricultural scientific research should not only depend on government support, but also use foreign investment. Domestic and international cooperation in agricultural research and application should be enhanced, and the communication with other countries should be encouraged to provide more platforms for foreign and domestic enterprises, individual agricultural sci-tech enterprises, agricultural high-new technology demonstration bases[3].

2.4.4 Financial support policies. Support of bank is also an important source of agricultural science and technology fund. All agricultural enterprises should fully use bank capitals for scientific research, application and promotion of research fruits. In addition, banks should be encouraged to develop agricultural sci-tech innovation fund, such social capitals as credit financing and risk capital should be introduced to promote agricultural technological

innovation and found agricultural sci-tech undertakings.

2.5 Cultivating more talents of agricultural technology

2.5.1 Training leading agricultural technicians. Effective measures should be taken to cultivate top talents of agricultural technology, encourage them to carry out international pioneering researches, and establish projects by considering needs of agricultural production and peasants of China. Scientific research institutes have to improve their talent incentive mechanism, provide them favorable scientific research conditions, give rewards to staff with outstanding achievements, so as to arouse their enthusiasm and play their leading role.

2.5.2 Enhancing the training of grassroots agricultural technicians. Application and promotion of agricultural research fruits depend on grassroots technicians, thus the cultivation and training of these technicians have to be enhanced. Experts from agricultural colleges should organize more training courses for technicians from grassroots agricultural service stations to strengthen their capacity of mastering and applying new knowledge and technology.

2.5.3 Cultivating practical talents. Practical rural talents mainly refer to rural economy management talents, experts from county-level and town-level agricultural management departments and agricultural colleges should take charge of the training of such talents. More leading agricultural technicians, grassroots agricultural service staff and practical talents should be cultivated, their sci-tech quality, vocational skills and service quality should be improved comprehensively so as to play the backbone role of these talents in agriculture and rural economy[3], and promote the development of agriculture, rural economy and society.

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(From page 6)

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