Shaoyun Guo*
Zibo Vocational Institute, Zibo 255314, China

Development of Low-carbon Agricultural Technology in China / Desenvolvimento de baixa emissão de carbono Tecnologia Agrícola na China

abstract

Low-carbon agricultural technology mainly develops technologies such as saving agriculture, new breeding, more efficient utilization of organic fertilizer, utilization and development of renewable energy resources, recycling of agricultural technologies and farming system innovation and so on. Nowadays, the main problems encountered in the development of low carbon agricultural technology in China are the shackles of traditional ideas, the imperfection of relevant systems and the technological lock-in encountered in the process. The solution is to revitalize agriculture through science and technology, adopting various agricultural science and technology promotion modes, perfecting the laws and regulations system, and vigorously developing low-carbon agriculture.

resumo

A tecnologia agrícola com baixa emissão de carbono desenvolve principalmente tecnologias como a poupança de agricultura, a criação de novos recursos, a utilização mais eficiente de fertilizante orgânico, utilização e desenvolvimento de energia renovável recursos, reciclagem de tecnologias agrícolas e sistema de cultivo inovação e assim por diante. Hoje em dia, os principais problemas encontrados em O desenvolvimento da tecnologia agrícola de baixa emissão de carbono na China é o grilhões de ideias tradicionais, a imperfeição de sistemas e o bloqueio tecnológico encontrado no processo. A solução é revitalizar a agricultura através da ciência e da tecnologia, adotando vários modos de promoção de ciência e tecnologia agrícola, aperfeiçoando sistema de leis e regulamentos, e desenvolvimento vigoroso de carbono baixo teor de carbono agricultura.

In 2009, China made a commitment of emission reduction to the world for the first time, committing that “China’s carbon dioxide emissions per unit of GDP will be decreased by 40%-45% by 2020”. To fulfill the promise and in view of the industry’s task of emission reduction, the development of low-carbon agriculture has become an inevitable choice for building a low-carbon economy. The technological innovation of low-carbon agriculture is an important means for China’s agricultural production mode to transform from extensive traditional type to green, safe and efficient low-carbon type.
section i

basic content of the development of low-carbon agricultural technology

(I) Connotation and characteristics of low-carbon agriculture

1. Connotation of low-carbon agriculture

Low-carbon agriculture refers to the “three-low and one-high” agriculture featuring low energy consumption, low pollution, low emissions and high efficiency. From farming land to dining table, continuous technological innovation of the agricultural products is carried out to optimize the industrial structure, reduce energy consumption and carbon emissions, the adverse economic and social impact in all aspects of the production are reduced to the minimum, achieving the largest agricultural economic benefits and a harmonious agricultural economic development mode that combines environmental protection and agricultural development. Hence it is the development direction of China’s modernized agriculture.

2. Characteristics of low-carbon agriculture

(1) Low energy consumption. Give full play to the recycling or reuse of different organisms in the production system by combing their characteristics, maximizing the benefits while using the agricultural production conditions as much as possible, but also reducing the resource consumption and carbon emissions.

(2) Sustainable production. Low-carbon agriculture both meets the needs of the current human society without destroying the needs of future generations and achieves sustainable development. It involves agricultural resources, environmental protection, food safety, farmers’ income increase and many other issues, and sustainable agricultural development is required.

(3) Green products and environment. Environmental protection runs through the whole process of low-carbon agriculture, production and ecology can meet the safety needs of human social development.

(4) Multi-field coordination. Low-carbon agriculture development involves a very broad area and needs to cooperate with each other. Production and ecology coordination, system soundness, management efficiency, technological innovation, etc. need to achieve sustainable development, but also to provide quality life and living environment for the people.

(II) Content of the development of low-carbon agricultural technology

Technological innovation is an important way to achieve low-carbon agriculture. With the development of science and technology, the application of new technology in agriculture is more and more extensive, including a wide range of content.

1. Economized agricultural technology

Economized agricultural technology includes the economizing of land, water, pesticide, fertilizer, etc. On the one hand, implement low-yielding field transformation technology to improve the proportion of high-yield arable land, on the other hand, implement stereoscopic planting and breeding mode, such as “paddy field duck raising” or “sugarcane-based fish pond” ecological agriculture system, to effectively improve the land output rate; take scientific measures to actively develop impervious channels and pipeline to reduce water leakage and evaporation, while vigorously promoting intermittent irrigation, drip irrigation, sprinkler irrigation, micro-irrigation and other water-saving agricultural technology to improve water use efficiency and water conservation; strengthen the development and promotion of anti-pest varieties, control technology of biological pesticides and pest, reduce the toxic side effects of pesticides on people and livestock and reduce environmental pollution. Focus on the implementation of soil testing and balanced fertilization techniques to reduce the amount of fertilizer application, lower groundwater and soil pollution and improve soil[1].
2. New breeding techniques

This technology enhances plant vitality, resistance to pests and diseases, yield per unit area, and the capacity of carbon storage. Breeding mainly consists of mutation breeding, cross breeding, genetic breeding, haploid breeding, polyploid breeding and cell engineering breeding[2].

3. More effective use of organic fertilizer

Excessive use of fertilizers can cause soil compaction, high carbon emissions and environment pollution. Organic fertilizer that is rich in humic acid is advocated, it can change and soften the soil structure, improve the organic matter content, increase crop yield with the rich nitrogen, phosphorus, potassium, calcium and other nutrients. However, the efficiency of organic fertilizer fertilizer is slow, easy to cause insufficient soil fertility, so in the process of fertilization, a certain ratio of cross-use of organic fertilizer and fertilizer can be carried out to maximize the effect.

4. Utilization and development of renewable energy

Renewable energy can be reused, such as hydroenergy, wind energy, solar energy, tidal energy, geothermal energy, etc. Establish wind power stations in wind energy-rich areas, hydropower stations in water-rich areas, solar power stations in solar energy-rich areas, and speed up the scale development and industrialization so as to apply to production, life, social and economic life enhancement.

5. Recycling agricultural technology

Recycling agricultural technology mainly includes fertilization, feed transformation and energy conversion of agricultural byproducts and waste. For example, straw turnover can cultivate fertility; R&D and application of biological engineering technology and maturity composting technology can develop manure of livestock and poultry and straws into biogas or organic fertilizer, reducing the pollution caused by direct fecal emissions and straws, also increasing energy; meanwhile, in the areas where the straw output is relatively large and concentrated, the silage method is used to convert the green straws into the silage of large livestock[1].

6. Innovation technology of agricultural system.

The innovation technology is based on soil tillage, including less tillage, no-tillage, direct rice seeding, irrigation, rotation and other techniques[1] that promote the restoration and protection of land, while reducing carbon emissions and carbon sequestration of agricultural production system.

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section ii

problems encountered in the development of low-carbon agricultural technology

(I) Shackles of traditional thought

1. Deeply-rooted traditional consciousness

Long-term family-based production and life mode determines the farmers to change the past depends on the agricultural mode relying on fertilizer and pesticides, with large environmental hazards and the need for a long-term transition. The promotion of new technology in rural areas must first break the farmers’ simple, easy to learn and low-cost traditional habits, and change their concept; second, the changes in ideas need to have enough knowledge of their own problems, there must be courage and determination to change, and the spirit to carefully study and practice; third, ample financial support. This are what the farmers in China are current lack of.

2. Solid traditional agricultural production and management mode.

In China’s long farming civilization, it has formed a unique decentralized agricultural production and management mode with cul-
tivated households, this mode hinders the effective promotion of new technologies, making it difficult to form a scale, while low-carbon agriculture requires a large-scale agricultural production mode.

(II) Imperfect related systems

1. Imperfect evaluation index system and supervisory system

Up to now, there is no related standards and measures for the evaluation criteria and supervision of low-carbon agriculture in China. The Evaluation System of China Low-carbon Cities promulgated on January 19, 2011 aims at the city’s low-carbon evaluation, almost no evaluation on low-carbon agriculture. With the lack of specific evaluation criteria and system, supervision will not exist. China’s traditional extensive production method causes farmers to have a relatively weak low-carbon awareness and difficulty in supervision. More importantly, China is forced to accept the low-carbon consciousness in the international environment, “we do not have a deep understanding of the patterns and paths to develop low-carbon agriculture, or even the basic consciousness of the necessity and urgency of developing low-carbon agriculture”[3]. Not finding an agricultural development mode in line with China’s actual situation, the supervision of low-carbon agriculture is out of the question.

2. Incomplete legal system of low-carbon agriculture

In 2001, the Ministry of Agriculture launched the “pollution-free food plan”, and developed Administrative Measures for the Safety of Places of Origin of Agricultural Products, followed by the promulgation of Cleaner Production Promotion Law of the People’s Republic of China, Circular Economy Promotion Law of the People’s Republic of China in 2009. These laws and regulations laid a foundation for the development of low-carbon agriculture, but there is a lack of policies and regulations on agricultural development in practice, in addition, China’s low-carbon agriculture development is also short of long-term planning.

(III) Problems encountered in the development of low-carbon agriculture

At present, China’s low-carbon agriculture development has encountered many constraints in the promotion of innovative technologies, specifically as follows:

1. Insufficient financial investment

   Most of the existing agricultural infrastructure in China has very low utilization rate, in order to play a greater role in agricultural production, more capital investment are needed for improving equipment utilization. At present, the government’s investment gap in low-carbon agriculture is relatively large. “The agriculture technology promotion expenditure of developed countries generally accounts for 0.6%-1.0% of the total agricultural output and about 0.5% in developing countries, but less than 0.2% in China[3]. Capital investment is obviously insufficient.

2. The lack of fine labor

   The promotion and application of new technologies require extensive participation of fine labor. At present, a large number of rural laborers in China are engaged in a wide variety of urban industries, while the weak, old, women and young people who are left behind are mainly engaged in agricultural production. They latter can not shoulder the task of promoting low-carbon agricultural technology, and the lack of rural labor has become an indisputable fact.

3. Serious constraints of agricultural production mode

   First, the decentralized agricultural production pattern of decentralized farmers hinders the promotion of new technologies; secondly, the degree of organization of farmers’ production is low, the risk of applying new technology is lack of effective risk aversion, and farmers have little interest in accepting and applying new technology; third, the level of rural industrial structure is low. At present, China’s rural industry is still in the extensive production stage, the producers rely mainly obtain a certain income by relying on the old tradition and old experience, with little interest in the use of new technology.

4. Lagging information construction

   Compared with the developed urban network, the rural information construction is lagging behind. At present, China has less agriculture-related networks, insufficient resource library construction investment, lack of rural science and technology
information resources, incomplete agriculture-related computer application system, lack of a complete agricultural service system. Farmers lack an effective and convenient information channel to understand low-carbon technology, and it is difficult to popularize innovative technology in rural areas[4].

5. Lack of financial support

Due to low profits, long recycling cycle, so in the field of rural finance, credit cooperatives are in a monopolistic position. Farmers require much capital investment in using new technology. Rural credit cooperatives can not meet the large financial needs, farmers are difficult to obtain loans from credit cooperatives, some good projects and products are given up due to funding problems, which greatly hampered the application and promotion of new technologies, reducing the enthusiasm of farmers to use new technologies.

section iii

the path to overcome obstacles in the development of low-carbon agricultural technology

(I) Develop agriculture by science and technology, improve rural education and service system

1. Improve rural basic education and science and technology education system

The government should increase investment in rural education, raise the cultural quality of the rural population, and transform the population burden into human resources. On the one hand, ensure that every child in rural areas can go to school, achieve a balanced development level of compulsory education; on the other hand, strive to develop vocational education combined with the actual situation in various regions, implement order training with local vocational institutions to train a number of technical experts for low-carbon agriculture.

2. Construct a new agricultural science and technology service system for the small-scale peasant economy base

On the one hand, play the local geographical advantages combined with China’s national conditions and the development path, establish a village-based, village organization/cooperative organization-relied low-carbon agriculture service system, popularize new knowledge of low-carbon agriculture by making full use of various media; on the other hand, organize relevant experts to carry out in-depth fields and on-site guidance aiming at the needs of farmers, make timely resolution of various problems and accelerate the application of innovative technology.

3. Establish a high-quality talent team

Talent is the key to promote the development of low-carbon agricultural technology. The development of the technological innovation of low-carbon agriculture requires three types of talents. First, high-level technology R&D talents. Technology is the top priority in developing low-carbon agriculture, so we need to tackle problems in key technologies of low-carbon agriculture by increasing research input, establishing key fund projects and through other means, mobilize the enthusiasm of R&D personnel and build a high-level technology R&D team. Second, hard-working agriculture technology promotion talents. In rural areas, the promotion of new technologies need to be guided and explained patiently. The underdevelopment of the agricultural network and the quality of the peasants have
determined that these people must be hardworking and familiar with the local land situation and crop cultivation, and can actually guide farmers to use new technologies to transform low-carbon agricultural technology into real productive forces. Third, practical and efficient management talents who can effectively manage the agricultural production and management activities, develop the development potential of the low-carbon and green agricultural market space[5], and improve the practicability of the new technology.

(II) Establish a network model of agricultural technology promotion

1. Establish a diversified model of agricultural technology promotion. First, strengthen the functions of the government-led six-agriculture technology promotion system, improve the efficiency of promotion, publicize and introduce the latest achievements in scientific research, and turn science and technology into practical productivity. Second, encourage scientific units, institutions of higher learning and users to actively communicate, make two-way choices to meet the innovation needs of different agricultural science and technologies, and to achieve theoretical and practical win-win situation. Third, encourage the establishment of non-governmental agricultural technology promotion agencies, drive a large number of people by a small number, and achieve the transformation of agricultural science and technology.

2. Shorten the path of agricultural technology promotion, reduce the intermediate links in the process of agricultural technology promotion, and promote the extensive communication between the innovative subject and the application subject. In the real agricultural production, “experts, base, farmers”, “experts, associations, farmers”, “experts, leading enterprises, farmers” and other modes can shorten the path to promote agricultural science and technology, solve the separation between scientific research and promotion and between technology and application[6-10].

3. Construction of agricultural science and technology innovation and application network

(1) Encourage farmers, agriculture-related enterprises, university-student village cadres, village cadres, agricultural science and technology personnel, farmer cooperation organizations to actively participate in the application and practice of agricultural science and technology, accelerate the application of new agricultural technology.

(2) Strengthen the network link and cooperation between the application subjects. In addition to professional vocational education of agriculture science and technology knowledge, farmers and agriculture-related enterprises should also strengthen mutual learning, learn from each other and improve the application ability of new agricultural technology.

4. Strengthen the construction of rural cooperative organizations, and deal with market risks with a larger scale of agricultural production to obtain more profits.

(III) Building a system environment conducive to the development of low-carbon agriculture

First, establish a low-carbon agricultural development policy system, improve the relevant laws and regulations, develop technical standards and requirements, implement a long-term development plan, so that low-carbon agriculture development and supervision have laws to abide by. Second, increase financial support. On the one hand, strengthen the construction of farmland water conservancy infrastructure, the government invests in the construction of large low-carbon agriculture demonstration projects to guide and change the farmers’ production concept. On the other hand, subsidize low-carbon agriculture projects with significant social and environmental benefits and promote the application of new technologies. Third, increase policy support, develop economic policy and tax policy that support and encourage enterprises and people to participate in the development of low-carbon agriculture, achieving revenue maximization of private income and social benefits.
references


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