



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Necessity and Feasibility of Developing Low Carbon Agriculture in Xuzhou City

Chengkui QIANG¹, Yuehua QIN¹, Shengyong WANG², Baoya ZHOU¹, Wujian FENG¹, Songsong WANG^{2*}

1. Xuzhou Key Laboratory of Modern AgroBiotechnology, Xuzhou Vocational College of Bioengineering, Xuzhou 221006, China; 2. Office of Science and Education, Xuzhou City Agricultural Commission, Xuzhou 221018, China

Abstract According to the characteristics of low carbon economy and low carbon agriculture at home and abroad, and combining with actual situations of agricultural development in Xuzhou City, the necessity of developing low carbon agriculture in Xuzhou City is analyzed by the perspectives of its agricultural production conditions, agricultural modernization, comprehensive competitive power, ecological civilization and low carbon economy. Simultaneously, the feasibility of developing low carbon agriculture in the city is discussed through low carbon technology, rural land management model, agricultural input channel, agriculture-related scientific research system, agricultural research transformation mechanism and rural personnel training program to provide some references for promoting the rapid and sound development of low carbon agriculture in Xuzhou City.

Key words Low carbon agriculture, Necessity, Feasibility, Xuzhou City

Global climate change resulted from excessive discharge of greenhouse gases (carbon dioxide, methane, nitrous oxide and so forth) by human activities has become a global environmental problem. Low carbon economy based on low energy consumption, low emission and low pollution has aroused more and more concern in many countries and is listed as a fundamental way to handle this problem. Research results indicate that low carbon agricultural technology can compensate for 80% of the agricultural greenhouse gases that are major sources of greenhouse gases. And the technology has become an only alternative of human beings to deal with grain security problem resulted from global climate changes at present and even in the foreseeable future^[1–2]. As the central city of Huang – Huai – Hai area, Xuzhou City is actively developing modern agriculture which has been one important strategy of speeding up revitalizing the old industrial base. At present, it is urgent to transform agricultural development pattern on the basis of its location advantages and speed up the establishment of low carbon agricultural development model with distinctive characteristics of Xuzhou City. In this large environment of the booming development of low carbon economy, the necessity and feasibility of developing low carbon agriculture in Xuzhou City are analyzed to provide some references for actively developing low carbon agriculture in this area.

1 Necessity of developing low carbon agriculture in Xuzhou City

1.1 Responding to agricultural production conditions of Xuzhou City

Xuzhou located the economic low-developed area

in northern Jiangsu Province is a large city that traditional agriculture gives priority to. Its "small, broken and separate" agricultural land is not favorable for realizing large-scale agricultural economy; the infrastructures, especially river basin facilities, is incapable of fighting against floods and droughts; modern agriculture is improper in industrial distribution and its technological content is on the low side. Simultaneously, the agricultural production method is backward. All these have been seriously restricted the sound and rapid development of agriculture^[3]. The core of low carbon agriculture is to transform agricultural production and living modes, and completely upgrade the agricultural labor productivity with the aid of technical innovation. In other words, it is to obtain maximum benefit of agricultural production with minimum input of land, energy and manpower. Thus, low carbon agriculture is not only the inheritance and sublimation of modern agricultural idea, but also proves vividly its necessity in overall improvement and upgrade process of agricultural production conditions in Xuzhou City.

1.2 Realizing agricultural modernization of Xuzhou City

As a new approach to solving issues concerning agriculture, countryside and farmers, transforming urban-rural dualistic structure, and building a well-off society, balanced urban-rural development is properly implemented by breaking the bottleneck of resource and environment elements faced by different industries, sectors and regions, removing the restriction of production factors (land, energy source and environmental protection index), and lift social, economic and environmental benefits in the process of agricultural modernization^[4]. The development of low carbon agriculture is to develop biological energy, extend energy saving technologies, optimize energy structure, minimize energy cost, improve input efficiency, reduce environment improvement cost and promote cost reduction and efficiency increase in all aspects. Low carbon agriculture not only can put right the agricultural development direction and maintain sound and rapid development of agriculture, but also

Received: January 12, 2013 Accepted: March 15, 2013

Supported by Agricultural Sanxin Engineering Project of Jiangsu Province (SX [2011]380).

* Corresponding author. E-mail: bioqck@163.com

can strengthen the position of central city in Huang – Huai – Hai area. Thus, it is really necessary for realizing agricultural modernization of Xuzhou City.

1.3 Improving comprehensive competitive power of Xuzhou City As a city with ten leading industries, ten regional distribution and ten leading industrial chains taking shape, Xuzhou City is rich in vegetable, edible fungus, forest and fruit and aquaculture resource. Its characteristic agricultural products, such as Chinese yam, burdock, asparagus, ginkgo and biological meat duck, have enjoyed great popularity both at home and abroad. However, with increasing demand of international market for agricultural product safety and farmland environmental quality, the reactive mechanism of Green Barriers to Trade (GBT) promotes the emphasis laying on pre-production, in-production and post-production sections for low carbon agriculture with "saving, high efficiency and safety" and "three high and one low" advantages. Low carbon agriculture suits for China's objective of building resource-saving and environment-friendly agricultural production system, and is quite necessary for increasing the shares of Xuzhou City's agricultural products in domestic and foreign market and improving the comprehensive competitiveness.

1.4 Promoting ecological civilization of Xuzhou City At the 7th City Forest Forum of China, vice mayor, Qi Guanshan, of Xuzhou City, stated the "Moving southward for 400 km" key project of ecological restoration and initiated the whole city to implement the works of restoring ecological vegetation, restoring green mountains and clear water, and expanding lakes and extending green space. Besides, the proper construction of green mountains, clear water, blooming flowers is considered as enrichment and development of urban ecological culture, and included into major works of City Committee and Government at present and in the foreseeable future. However, agricultural production is confronted with a series of ecological and environmental problems, such as agricultural non-point source pollution, severe soil erosion, reduction of soil fertility, frequent flood and drought, as well as straw burning and so forth. These have seriously breached the realization of the harmony between agricultural production and nature in ecological civilization era^[5]. Since low carbon agriculture has advantage of transforming agricultural production model, developing agricultural biomass energy, ensuring high and stable yield of crops, and reducing global warming trend, it caters for sustainable development from the perspective of Scientific Outlook on Development, and so it is necessary for promoting ecological civilization in Xuzhou City.

1.5 Developing low carbon economy of Xuzhou City Low carbon economy, formed for dealing with energy crisis and global warming, has already concerned our country's and even the world's energy security, transformation of economic growth model and common weal, and can greatly redefine powerful strength of all countries and regions in the future development^[6]. For example, Xuzhou Municipal Government had stated clearly the objective of lowering the energy consumption by 4.832% in compliance with

the index issued by Jiangsu Provincial Government and the overall energy consumption reduction index of the Eleventh Five-Year Plan period. However, rich low carbon resources in agriculture and rural areas and broad development space of low carbon economy have been overlooked for a long time. For example, green house gases discharged from farmland and animal husbandry reach 10% – 12% and 18% of the total amount of the world respectively. It seems that Xuzhou City, with an area of 590 580 hm² cultivated land can participate in global climate change capability construction and sustainable development of agriculture through energetically developing low carbon agriculture. And it also highlights the necessity of developing low carbon agriculture for low carbon economy in Xuzhou City and even the national economic explosion.

2 Feasibility of developing low carbon agriculture in Xuzhou City

2.1 The feasibility of low carbon technology in Xuzhou City

The low carbon industry includes three fields: energy-saving and emission-reducing, new energy and renewable energy and CO₂ capture and sequestration, involving many sectors, such as transportation, energy, building, chemical, petrochemical, metallurgical, automobile and material sectors^[8]. At present, on the basis of carbon saving and fixation mechanism of low carbon agriculture, various new carbon saving and fixation technologies and models have been developed and popularized, such as rebuilding agricultural wetland system, reducing consumption of high carbon energy and fertilizer, improving new carbon-fixing agricultural varieties, extending agricultural carbon-fixing technologies and developing agricultural circular economy^[4]. Therefore, rapidly developing low carbon technology, especially low carbon agrobiotechnology, provides technical support for new development of low carbon agriculture in Xuzhou City.

2.2 The feasibility of rural land management model For now, the innovation of rural land management model in Xuzhou City mainly includes stabilizing farmers' contractual management right of land through strengthening household contractual land, area, contract and license; enhancing overall management of rural current land by implementing strict land-use planning and land-use standard; making clear current situation of soil quality, evolution laws, spatial distribution characteristic and future change trend by thorough land quality survey, to improve quality of cultivated land; gradually pushing forward some reforms of household registration, social security, land use and administration systems, to actively explore reform approaches of "exchanging social security with contractual land and exchanging urban house with home-stead". This shows that gradually standardized rural land management model ensures sustainable development of low carbon agriculture in Xuzhou City through providing the basicest production material, *i. e.* rural land.

2.3 The feasibility of agricultural input channels Presently, the innovation and development of agricultural input channels in Xuzhou City mainly include: (1) introducing urban industrial and

commercial capitals, and cultivating new agricultural capital investment and financing subjects through establishing agriculture-related industrial groups by means of purchase, merger and integration; (2) enhancing financial services and supporting agricultural intensive and large-scale management through credit, agricultural guarantee, agricultural insurance, co-guarantee loan, and taking powerful grain production households and large aquaculture families as key objects of advance payment for future purchases; (3) developing and implementing preferential policies to encourage farmers' self-employment through creating barrier-free environment and; (4) strengthening hematopoietic function of collective economy through stock right realization of collective land, demutualization of collective assets, and farmers' land cooperation. Therefore, developing and perfecting agricultural investment channel provide support for stable progress of low carbon agriculture in Xuzhou City at the level of agricultural capital element.

2.4 The feasibility of agriculture-related scientific research system Under the new background, the innovation and development of agriculture-related scientific research system in Xuzhou City are mainly achieved through the untiring effort of Low Carbon Energy Institute of China University of Mining and Technology, School of Life Science of Xuzhou Normal University (now Jiangsu Normal University), Xuzhou Academy of Agricultural Sciences, School of Environment Engineering of Xuzhou Institute of Technology, and Department of Agriculture and Forestry Engineering of Xuzhou Vocational College of Bioengineering, through integrating resources to set up low carbon public technology innovation platform, and through stressing construction of technical standard, information, data, consultation, product certification and technical training systems^[9-10]. This is intended to promote research, development and extension of high efficiency and low emission energy technologies, and accelerate low carbon agriculture to take root in Huang - Huai - Hai area and maintain rapid and sustainable development responding to global climate change. Therefore, it can be seen that establishment and development of agriculture-related scientific research system may provide support for pushing forward low-carbon agriculture in Xuzhou City.

2.5 The feasibility of agricultural achievement transformation mechanism In the new stage, innovation and development of agricultural achievement transformation mechanism mainly include (1) energetically supporting agricultural sci-tech model households or enterprises through cultivating sci-tech model households' ability of learning and acceptance, radiation and driving and self-development ability; (2) promoting the rapid commercialization and industrialization of agricultural hi-technologies through establishing ecological agricultural demonstration area; (3) perfecting multiple level agricultural technological extension service system through establishing and implementing "responsible agricultural technological extension system". Therefore, smooth mechanism of agricultural sci-tech achievement extension and transformation can provide guarantee for in-depth development of low carbon agriculture in Xuzhou City at the level of agricultural

popular science element.

2.6 The feasibility of rural talent training program Under the new situation, the innovation and development of rural talent training program in Xuzhou City mainly include (1) establishing new farmer training center to cultivate village cadres and experts of getting rich and conduct periodic training and build multiple level training network; (2) selecting qualified village branch secretary and cultivating Party member team and leaders of getting rich; (3) enhancing the construction of rural leaders, focusing on selection of rural practical talents and classified and dynamic management work, and establishing and improving rural talent cultivation and management mechanism. Therefore, increasingly perfect rural talent training program can provide support for making solid progress of low carbon agriculture in Xuzhou City at the level of rural talent element.

3 Conclusions

Low carbon agriculture is a new type of agriculture appeared for responding to global climate changes. It is greatly favorable for the rapid development of low carbon agricultural economy, and presents a new idea and path for solving issues concerning agriculture, farmers and rural areas. At present, agricultural modernization based on the low carbon economic development model is still rare in the world, so it is an unprecedented opportunity for Xuzhou City or even the whole China to transform agricultural development model. As a central city in Huang - Huai - Hai area, Xuzhou City should seize this opportunity to develop low carbon agriculture, actively participate in research, development and transformation of low carbon agricultural technologies, and attach great importance on introduction of professional talents and local talents, so as to comprehensively revitalize its economy. It is firmly believed that low carbon agriculture will have important theoretical significance for optimizing agricultural industrial structure and in-depth development of modern agriculture of Xuzhou City, and its practical value will be fully manifested.

References

- [1] WENG ZH, LIN HQ, KE WH, *et al.* Strategy and inspiration for low-carbon agricultural development of Taiwan[J]. *Fujian Journal of Agricultural Sciences*, 2009, 24(6): 586 - 591. (in Chinese).
- [2] ZHANG KM. The development of low carbon economy should have a sense of urgency[J]. *Truth-seeking*, 2009(23): 50 - 52. (in Chinese).
- [3] XU YS. Pathway for Xuzhou agriculture modernization[J]. *Journal of Xuzhou Normal University: Natural Science Edition*, 1998, 16(3): 57 - 61. (in Chinese).
- [4] LI XY, WANG BB. The necessity and pathway of developing low-carbon agriculture in Sichuan Province[J]. *Journal of Southwest University for Nationalities: Human Social Science Edition*, 2010(1): 103 - 106. (in Chinese).
- [5] LI XY, WANG BB. Low-carbon agriculture: Agriculture development road in climate change [J]. *Rural Economy*, 2010(3): 10 - 12. (in Chinese).
- [6] DU SK. Low-carbon agriculture: Huge potentiality low-carbon economic field[J]. *Rural Economy*, 2010(4): 3 - 5. (in Chinese).
- [7] Xuzhou Statistical Bureau. Cultivated land area in main years [M]// *Xuzhou Statistical Yearbook in 2008*. Beijing: China Statistic Press, 2009: 154. (in Chinese).

(To page 30)

search, and increase capital investment to ensure that the breeding and related research work on high-quality inbred rice in the region is carried out smoothly.

2.3 Focusing on solving the problem of low amylose content in the improvement of rice quality

In recent years, the rice quality of high-quality inbred rice variety in the region has been greatly improved, but the low amylose content is still the region's primary issue to be solved in the improvement of rice quality of high-quality inbred rice. In breeding practice, it is necessary to fully explore the high-quality inbred rice germplasm resources with medium amylose content, such as Baguixiang 713, Guixiang No. 1, Yalin No. 3, Guiyu No. 7 and Guizhan No. 4 that have been examined and approved. In addition, there is a need to introduce the existing high-quality variety resources with medium amylose content at home and abroad, then directly use them or innovate upon them as hybrid strain.

2.4 Further improving the yield per unit area of high-quality inbred rice by improving the thousand-grain weight

The production of inbred rice is lower than that of hybrid rice, which is always an obstacle to the development of high-quality inbred rice in the region. Through statistical analysis on the relationship between the regional tested production of variety bred in Guangxi and thousand-grain weight, it is found that in the varieties with production higher than 6300 kg/ha, the varieties with thousand-grain weight higher than 20 g account for 90.0%, while in the varieties with production lower than 6300 kg/ha, the varieties with thousand-grain weight higher than 20 g only account for 42.9%, indicating that increasing thousand-grain weight can greatly improve yield per unit area. In the future, it is necessary to take the thick-and-long-grain rice type as breeding objectives, and without reducing the quality of rice, increase thousand-grain weight to further improve the yield per unit area of high-quality inbred rice, in order to achieve a higher level of harmonization of high quality and high yield.

2.5 Strengthening disease-resistant and degeneration-resistant breeding

Guangxi is the region severely hit by rice blast, so the use of disease-resistant variety is the most direct, most economic and most effective measure to prevent this disease, but currently the breeding of high-quality inbred rice in Guangxi resistant to rice blast still has not make a breakthrough. In the future, on the one hand, it is necessary to further strengthen the disease-resistant breeding, introduce from abroad or explore the excellent germplasm resources with high rice quality and high resistance to rice blast; take the currently promoted high-yield and high-quality inbred rice variety as the recurrent parent to crossbreed it with disease-resistant germplasm resources, then backcross it with the re-

current parent 1 or 2 times, and arrange the backcrossed progeny in the blast zone to be planted; directly select high-yield, high-quality disease-resistant strains in the disease zones, to breed new high-yield, high-quality and high-resistance varieties. On the other hand, it is necessary to strengthen exchanges and cooperation between breeders and plant protection experts, to conduct joint research and accelerate the process of disease-resistant breeding.

Agro-meteorological disasters occur frequently, seriously threatening the safe production of high-quality inbred rice in Guangxi. Improving the degeneration-resistance of variety is a fundamental way to solve this problem. It is necessary to increase the personnel and capital input to the research on degeneration-resistant breeding of high-quality inbred rice, introduce high-quality degeneration-resistant parent for the use, attack key problems in degeneration-resistant breeding, and breed high-yield, high-quality and high-resistance variety as quickly as possible, to ensure the safe production of high-quality inbred rice in Guangxi.

2.6 Improving the application of modern biotechnology in the breeding of high-quality inbred rice

The high bio-technology has incomparable advantages, laying a strong technical foundation for the improvement and selection of individual genetic traits. The high bio-technology is still at the auxiliary stage of breeding, but it has shown a strong supporting role. Molecular marker-assisted selection breeding technique effectively improves the selection efficiency of target gene, which has been widely used in the screening of important disease-resistant, insect-resistant genes (Cheng Yongsheng *et al.*, 2005). In the future, it is necessary to strengthen the combining of conventional breeding methods and molecular marker-assisted selection breeding technique, to accelerate the disease-resistant and degeneration-resistant breeding process.

References

- [1] Chen YM, JIANG XB, LUO QC, *et al.* Several problems and breeding strategy in high-quality inbred conventional rice varieties in Guangxi [J]. Journal of Anhui Agricultural Sciences, 2004, 35(3):249–252. (in Chinese).
- [2] CHEN YM, ZHANG XJ, CHEN CH, *et al.* Study on genetic diversity in aromatic rice [J]. Journal of Anhui Agricultural Sciences, 2006, 34(22): 5794–5797. (in Chinese).
- [3] CHEN YM, ZHANG XJ, CHEN CH. Development and current research of aromatic rice [J]. Guangxi Agricultural Sciences, 2007, 38(6):597–600. (in Chinese).
- [4] CHENG YS, LIAO YP, CHEN ZM, *et al.* Breeding status and development trend of high-quality rice in Guangdong Province [J]. Guangdong Agricultural Sciences, 2005, (6):14–15. (in Chinese).
- [5] LUO QC, WEI SF, JIANG XB, *et al.* Advances in high-quality rice breeding of Guangxi and its production suggestions [J]. Guangxi Agricultural Sciences, 2003, 34(2):6–7. (in Chinese).

(6): 32–33. (in Chinese).

- [10] GAO WL, SHI SG, XU L, *et al.* The concept of low-carbon agriculture and value embody [J]. Jiangsu Agriculture Science, 2011, 39(2): 13–14. (in Chinese).

(From page 26)

- [8] LIU SB, DU YJ. Low-carbon technology and industry development status and countermeasures [J]. Anhui Science and Technology, 2009(12): 28–29. (in Chinese).
- [9] YU ZF. Low-carbon economy and technique [J]. Zhejiang Economy, 2010