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The Construction of Ecological Agriculture in Gongcheng County and Its Development Ideas

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Abstract On the basis of survey of current situations of eco-agricultural construction in Gongcheng County, major "Cultivation + Methane + Planting" triple model of ecological agriculture in Gongcheng County is presented. Then, the eco-agricultural benefits of Gongcheng County are analyzed from three aspects, namely economic, social and ecological benefits. Through summing up, the eco-agricultural construction of Gongcheng County has following problems: imperfect ecological technological system; follow-up service level and ability to be improved; slow in unified planning and design and industrialization step. Finally, ideas of further development of ecological agriculture in Gongcheng County are put forward. These include proper planning and overall management, extending ideas and deepening eco-agricultural construction system; strengthening development of ecological tourism; and perfecting social service system for ecological agriculture.

Key words Gongcheng County, Ecological agriculture, Development ideas, China

Currently, all countries give top priority to ecological environment construction and sustainable development. The ecological agricultural development model features recycling and is a basic model for realizing sustainable development of agriculture. Developing the ecological agriculture is the need to achieve sustainable agricultural development and construction of new socialist countryside. In China, the ecological agriculture is "an agricultural system established and developed on the basis of summarizing successful experience of various agricultural modes under coordinated development of economy and environment, on the principles of ecology and economics, and by systematic engineering method. It requires combining grain production and industrial crop production with developing farming, forestry, animal husbandry, sideline production and fishery, combining multi-form agriculture with the secondary and tertiary industries, utilizing essence of traditional agriculture and modern science and technology, coordinating the relation between development and environment, and the relation between resource utilization and environmental protection through artificial design of ecological engineering, finally to achieve virtuous cycle in both ecology and economy"^[1].

Gongcheng County is one of 12 counties of Guilin City in Guangxi Zhuang Autonomous Region, and also one of the demonstration counties launched in the second batch of the national demonstration county for ecological agriculture. Since the construction of ecological agriculture was started in the 1980s, it has made remarkable achievements, but there are still some restrictive factors. From survey and analysis of current situations of ecological agricultural construction in Gongcheng Coun-

ty, and thinking on further development of ecological agriculture, it is expected to provide reference for ecological agriculture developing to a new step.

1 General situations of agriculture in Gongcheng County

The full name of Gongcheng County is Gongcheng Yao Autonomous County. It is located in southeast of Guilin City, at 110°36'–111°10' E, 24°37'–25°17' N. With a total area of 2 149 km², it is surrounded by mountains in eastern, western and northern sides. Its middle areas are river valleys and hills. The average temperature of the whole year is 19.7 °C and the average annual rainfall is 1 437.7 mm^[2]. Ground surface in Gongcheng County shows a typical karst landform. There are large areas of stone mountains. In the whole county, the cultivated area is 19 000 hm², only accounting for 8.8% of whole area. These include 11 900 hm² of paddy field and 6 800 hm² of dry land separately accounting for 62.6% and 37.4% of the total cultivated area^[2-4]. Previously, the agricultural production form is simple in Gongcheng County. Farmers mainly plant rice and sugarcane. Due to hostile agricultural ecological environment, agricultural income is low, farmers are badly off. Thus, in the past, Gongcheng County is a typical underdeveloped minority county, and also a famous poor county in Guangxi. Since the 1980s, Gongcheng County started bringing into full play its natural resource advantages, developing the triple ecological agriculture with "cultivation as major point, planting as leader and marsh gas as link", explored the nation-wide famous "Gongcheng Model", achieved a road of sustainable development, and established the "national eco-agricultural demonstration county". As a result, the ecological environment of agriculture is greatly improved, living standards of the people are increasingly improved, and outstanding ecological, economic and social benefits have been obtained.

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2 Current situations of eco-agricultural development in Gongcheng County

Since Gongcheng County started the construction of ecological agriculture in 1983, it firstly started with construction of methane pool and solving rural energy problem. With many years of practical exploration, it has gradually established ecological construction base and eco-agricultural model, realized a characteristic Gongcheng eco-agricultural way, and made great achievements. In 2000, Gongcheng County was listed into the second batch of eco-agricultural demonstration counties. From then on, Party Committee and government of Gongcheng County attached great importance to development of agricultural and rural economy through developing ecological agriculture and characteristic industry. On the basis of local conditions, they made such important policies as "catching the agriculture through jumping out of the traditional agricultural scope, speeding up industrial structure adjustment, improving eco-agricultural quality, and quickening the agricultural industrialization"^[2]. It started a new pioneering drive in the eco-agricultural development of this County with construction engineering system of "prosperous ecological home" as carrier. Through several years of efforts, Gongcheng County successfully passed the acceptance of national eco-agricultural demonstration counties in 2004, and won the title of "National-level Eco-agricultural Demonstration County".

2.1 Major eco-agricultural models of Gongcheng County

In Gongcheng County, the most basic and typical eco-agricultural model is "cultivation + marsh gas + planting" (also referred to as "Pig + Methane + Fruit") triple mode (shown in Fig.1 and 2), which is the nation-wide famous "Gongcheng Model"^[1]. Major contents of "Gongcheng Model": take farmers as basic units, use hilly areas, water surfaces and courtyard in front or behind of the house to build livestock and poultry housing, methane pool, and orchard. At the same time, methane pool, livestock and poultry housing and toilet are combined together to form "cultivation + methane + planting" triple courtyard economic pattern to promote virtuous cycle of ecology. People's living wastes, crop's straw and pigs' excrement and urine are fermented in the methane pool. The generated methane can be used mented liquid on leaves for top-dressing, so as to reduce flower dropping and improve the rate of fruit-setting, and reduce the us for lighting and cooking. The fermented liquid can be fed to pigs, while the fermented residues are used as base fertilizer for fruit trees. Before the fruit trees bear fruit, it is able to plant such industrial crops as peanuts and gingers. Besides, after fruit trees blossom and bear fruits, it is able to spray fere of chemical fertilizer and pesticide.

Great advance of methane construction promotes development of pig husbandry. More pigs will bring more fertilizers, so sufficient raw material supplied can be guaranteed for methane pool. Then, there will be more methane, fermented liquid and residues. Raw materials of agricultural production will increase. In that situation, farmers will explore and adjust models and constantly increase and extend the industrial chain. Consequently, there will be more new eco-agricultural models based

on the original "Pig + Methane + Fruit" model. For instance, in Ping'an Town, farmers dig small fishponds in orchard and vegetable plot, gradually form a new model of "One Pool with Four Small" (namely, one methane pool to drive one small piggery, one small orchard, and one small fishpond)^[4]. After Huiyuan Juice was settled in Gongcheng County, development of "Gongcheng Persimmon Fruit Wine" and development ecological tourism constantly extend and enrich connotation and denotation of "Gongcheng Mode". In Lianhua Town, farmers increase agricultural byproducts processing and ecological tourism parts on the basis of original "Pig + Methane + Fruit" model, gradually forming the "cultivation + methane + planting + processing + tourism" five - in - one modern eco-agricultural development model. Other places of Gongcheng County also take measures that suit local circumstances. Many types of ecological models emerge, such as "Pig + Methane + Lighting + Fruit + Predatory mites + Yellow board + Bagging", "Grain (Vegetable) + Pig + Methane + Fish", etc.

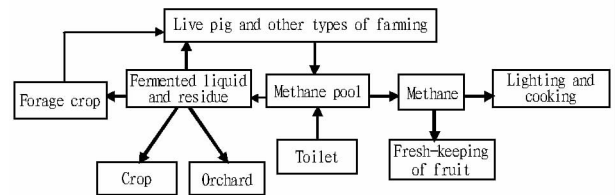


Fig. 1 Operating of the triple eco-agricultural model of "Pig + Methane + Fruit"

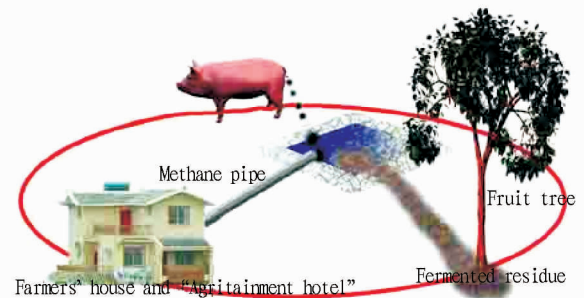


Fig. 2 Triple eco-agricultural development model of "Pig + Methane + Fruit"^[2]

2.2 Analysis of eco-agricultural benefits in Gongcheng County

With over two decades of unremitting efforts, Gongcheng people have established a well-developed ecological agriculture. This not only promotes development of rural economy, but also improves ecological environment. At the same time, remarkable economic, social and ecological benefits have been achieved.

2.2.1 Economic benefits. Among the above three types of benefits, economic benefits are the most active and dynamic factor, and also the issue that producers and investors mostly care about^[1,6]. After developing ecological agriculture, farmers of Gongcheng County use forage, residual straw, excrement and urine of people and animals to ferment methane, which is a type of clean energy and can be used for cooking, lighting and solving part of energy for living. If calculated at each household

using 2 degrees of electricity less than previously, it is able to save 438.0 yuan electricity fee annually (calculated as per 0.6 yuan/degree on the basis of 2010). The fermented liquid and residues are excellent organic fertilizers and can be used for feeding fishes. Currently, fermented liquid and residues are mainly used as crop fertilizers, and fermented residues are used as base fertilizer, which greatly reduce the purchase volume of fertilizer and raise both quantity and quality of agricultural products. In this way, it not only develops ecological agriculture, but also greatly promotes development of harmless, green and organic agricultural products. By now, over 20 types of harmless agricultural products, over 10 types of green foods and over 10 types of organic foods of Gongcheng County have been certified^[3]. Harmless persimmons of Gongcheng County have been sold in all parts of the country and sold to Southeast Asia. They are often in short supply and the economic benefits are remarkable. Beijing's Huiyuan Juice is also attracted to Gongcheng by rich fruit resources there. Meanwhile, Gongcheng people extend the industrial chain to ecological tourism. The annual Peach Blossom Festival and Persimmon Festival attract numerous tourists and become another growth point of local economy. According to surveys, in the first quarter of this year, Gongcheng County has completed a total output value of 605 million yuan, having an increase of 14.31% compared with the same period of last year; the income of social tourism reaches 178 million yuan, which has an increase of 305.7% compared with the same period of last year^[4].

2.2.2 Social benefits. Social benefits of ecological agriculture refer to social effects and benefits obtained from construction of ecological agriculture. Social benefits of Gongcheng County are mainly manifested in following aspects. First, rural hygienic conditions are improved, and people's living standard is improved. The methane is a renewable clean energy and a type of quality fuel. It is not only very convenient and fast, but also avoids smoke when burning straws and faggots, achieving a clean kitchen. Besides, it can avoid pollution to air. Second, farmers' quality is improved and construction of spiritual civilization in rural areas is accelerated. The construction of ecological agriculture requires certain cultural knowledge and scientific technology. Through learning, Gongcheng County has trained a batch of skilled personnel and experts for getting rich. The use of methane energy can make family labor force get rid of the heavy work of firewood cutting, and apply the saved time in getting rich, learning and cultural activities, which raise peoples' awareness of environmental protection and promotes change of ideas. Third, the remarkable achievement in eco-agricultural construction is favorable to gaining in popularity of Gongcheng and increasing the information source. Fourth, it provides a good place for leisure and learning experience of urban residents and scientific research institutions. Fifth, it promotes social harmony and stability. Developing eco-agriculture realizes the convergence of government and mass benefits, makes various principles and policies of the Party and government have a better implementation in rural areas. Besides, it effectively resolves various social conflicts. Both the criminal

cases and those cases involving public security are decreasing year by year. The social security is constantly improved, society and politics are steady, and masses of all nationalities live in peace and work contentedly^[5].

2.2.3 Ecological benefits. The ecological benefits are central parts of eco-agricultural construction. Developing eco-agriculture and replacing straws and faggots with methane as fuel not only effectively reduce vegetation damage and protect forest reserves, but also improve ecological environment and achieve virtuous cycle of "ecological utilization and ecological protection". Through bringing into play the link function of the methane in the ecological construction chain, on one hand, it is able to effectively resolve the great conflict between closing hillsides to facilitate afforestation and farmers cutting firewood for faggots. Calculated at each family burning 200 kg faggots every month, 30 000 families in the whole county can reduce 76.8 million kilograms of faggots annually if using the methane. If 50 000 families use the methane, 128 million kilograms of faggots can be saved, equivalent to a reduction of cutting 2 667 hm² forest. In 1991, the forest resource consumption if Gongcheng County is 156 400 m³, now it has reduced to 80 000 m³^[5,6]. On the other hand, the comprehensive utilization of methane energy can effectively solve the pollution problem of rural excrement and urine of people and animals and agricultural residues, and the environmental and hygienic conditions have a significant change in rural areas.

In 1988, the forest coverage in Gongcheng County is 54.2%; in 54.2%, it reaches 70.8%, and now it has exceeded 80.0%. The atmosphere environment quality in the county rises to the first level from the second level, and the quality of drinking water source reaches the national Class 2 standard, and quality of main rivers reach the corresponding functional zoning standard^[5]. Dirty, disorderly and bad rural living environment has turned to beautiful and clean environment. At the same time, popularization of ecological technologies promotes development of local green foods, reduces utilization of chemical products, makes the entire agricultural environment more favorable to sustainable development of agriculture, and lays a solid foundation for ecological county. In these situations, some people praise Gongcheng County that "in spring, it is a garden; in summer, it is a forest; in autumn, it is an orchard; and in winter, it is a park. In the whole year, it is a paradise"^[5].

3 Major problems existing in eco-agricultural construction of Gongcheng County

With over two decades of development, the development of ecological agriculture in Gongcheng County has made remarkable achievements, but there are still some problems and there is still a certain gap between the requirements of modern eco-agricultural development.

3.1 Imperfect ecological technological system Ecological technology is an important support for eco-agricultural development. On the whole, the expansion of ecological technology is a sole approach to overcoming reduction of profit and achieving high efficient and sustainable development of ecological agricul-

ture in the growth of agricultural economy^[6]. In an eco-agricultural system, the optimization technology for crop cultivation generally includes many parts, which have a very complex relation between each other. For example, to raise ducks in a fishpond, we should consider the quantity of ducks, which will be restricted from exchange speed of water, capacity of fishpond, water quality, type and quantity of fishes, water temperature, and ages of ducks, etc. Unfortunately, farmers do not have sufficient theoretical knowledge and experience to have a scientific design of this complex system, but rather copy experience of another place, as a result, the effect is not significant^[7,8]. Besides, the awareness of standardized production is weak in rural areas; production and management in breach of standards are still not completely solved; and there are still hidden dangers in quality safety of agricultural products and environmental pollution. In all, in the practice of ecological agriculture of Gongcheng County, there is still lack of research of technical measures, including the development of traditional technologies and the introduction of high and new technologies.

3.2 Follow-up service level and ability to be improved In Gongcheng County, there is still no effective service system, so it is impossible to provide quality technologies, products and information services for farmers in more villages. For instance, some methane pools built at an earlier time have failed due to technical reason, which dampens farmers' enthusiasm for developing methane. Some frontier and new information can not be received in time, which restricts the development of ecological agriculture to some extent. The ability of scientific and technological popularization and innovation in rural areas is not provided with effective follow-up mechanism, leading to farmers at grass-roots level difficult to obtain opportunity of higher level training and learning. In such high and new agricultural technologies as prevention and control of agricultural pollution, insect and pest, as well as production of organic foods, scientific quality of farmers is obviously low and restricts further development of ecological agriculture.

3.3 Slow in unified planning and design and industrialization step Ecological agriculture involves a lot of aspects of natural, social and economic fields. It is a systematic project. To achieve a wonderful eco-agricultural construction, we must make a complete plan and have an overall arrangement, make it develop in the right direction, and realize the simultaneous growth of ecological, economic and social benefits. Although the eco-agricultural construction has made certain achievements in Gongcheng County, it is necessary to proceed from the reality, make proper planning and determine further development ideas to build a higher level ecological county. Meanwhile, since the agricultural industrialization starts later in Gongcheng County, the fresh-keeping and processing of agricultural products are backward, so the ability to drive farmers is comparatively low, and it is impossible to turn the potential comparative advantages into actual competitive advantages.

4 Ideas of further development of ecological agriculture in Gongcheng County

4.1 Proper planning and overall management It is pro-

posed to combine the long-term goal and short-term interests, closely connect planting, cultivation, industry and commerce, farmland, villages and towns, and energy construction, and integrate the development of rural economy with protection of ecological environment^[9]. According to market demand, it is recommended to have an advance layout, introduce suitable new, high quality and special species; eliminate those types with low output, low quality and much disease; motivate and organize farmers to actively participate various getting-rich associations or economic development organizations to jointly resist market risks; on the basis of strengthening Huiyuan Juice, continue to introduce more fruit processing enterprises, support development of fruit processing leading enterprises, implement agricultural industrialized operation, to increase added value of fruits and increase farmers' income; in addition, it is proposed to constantly enhance the market system for fruit circulation, strengthen the fruit marketing team, encourage associations to make efforts to increase sales volume of fruits, and to widen channels for farmers getting rich.

4.2 Extending ideas and deepening eco-agricultural construction system First, it is necessary to bring into play advantages of green agriculture. On the "integral, coordinated, recycling and renewable" ecological principle^[9], in line with requirements of *Technical Specifications for Eco-agricultural Pilot Planning in Guangxi*, we should take measures in the light of the realities of specific regions, have an overall planning, bring into full play advantages of local resources, take green products as the industrial development direction, and energetically promote the production of harmless, green agricultural products, and organic foods. Second, it is essential to take industrialized development road. We should base on existing foundation and combine the construction of characteristic industry with construction of ecological agriculture. Besides, it is proposed to take the opportunity of eco-agricultural development, strengthen the introduction of processing enterprises including Beijing Huiyuan, Dalian Huikun, Luen Fat Food, concentrate on pushing forward development of ecological industry (fruit processing, bamboo processing, tea oil production, etc.), promoting ecological agriculture, so as to realize a simultaneous development of ecological agriculture and ecological industry.

4.3 Strengthening development of ecological tourism It is proposed to base on existing Peach Blossom Festival and Persimmon Festival to fully exploit the potential of ecological tourism, incorporate ecological concept into every links of tourism development, actively develop the tourism that integrates collective vacation, appreciating national customs, and experiencing labor delight, and expand the space of eco-agricultural development and increase of farmers' income. Take an example of Hongyan eco-agricultural tourist zone. Located in southwest of the Gongcheng County, it is the central zone of the county's ecological tourism. Its persimmon trees cover an area of 1 000 hm², so there is rich resource of orchard landscape. The national-level ecological demonstration village, Hongyan Village is situated there. Thus, this zone is orientated

as a parent scenic spot within the orchard. In reliance on charms of "Hongyan", it attracts numerous domestic and foreign tourists to come to rural areas to appreciate rural conditions, consequently it will bring along development of child scenic spot. The development direction of eco-agricultural tourism: it is planned to combine Hongyan Village and Persimmon Festival, and take the appreciation, picking, and experiencing agricultural cultivation as main parts, to develop sightseeing and picking orchard, bathing in forest, and experiencing life of new countryside. Besides, it is proposed to take various propaganda means to recommend agricultural products of this county, to make tourists deeply understand rich agricultural product resources apart from enjoying beautiful scenery of agricultural landscape, so as to indirectly popularize agricultural production. Especially the annual Persimmon Festival, agricultural products can be used as agricultural landscape resource. In the course of development, it shall not be limited to persimmons, but rather create golden agricultural landscape. Also, we can present various persimmon feasts to make tourists taste various persimmons, so as to promote production of persimmons and increase sales volume of persimmons. In the course of travel, tourists not only can feel rich agricultural scene, but also experience profound persimmon culture^[2,10,11].

4.4 Perfecting social service system for ecological agriculture The popularization of ecological agriculture not only needs active participation of local people, but also needs establishing a perfect social service system. Among these, the key is to establish comprehensive ecological service network before, during and after production, and establishing network platform for sales of agricultural products. This not only needs joint efforts of government and agricultural organizations, but also needs building service system for production, sales, processing, information, science and technology of ecological agriculture, as well as providing guidance and circulation service for ecological agriculture. In addition, Gongcheng County should also unremittingly carry out "Bringing Science and Technology to Villages and Families", energetically develop "Green Certificate" training, and implement Sunshine Project for Training Rural Labor Forces, so as to achieve benign development of ecological agriculture^[12].

5 Conclusions

Developing ecological agriculture is of great realistic significance and deep historic significance to realizing increase of agricultural benefits and farmers' income and guaranteeing sustainable development of agriculture and rural economy^[13], so it is a general direction of China's agricultural development. Gongcheng County has made certain achievements in construction of ecological agriculture. However, the eco-agricultural construction is a systematic project, it needs long-term efforts and feasible and effective measures to achieve unique functions and benefits of ecological agriculture. Therefore, it still needs careful exploration, and it is required to establish and

perfect new mechanism, method, and technology suitable for development of ecological agriculture in the new period, so as to push forward further development of ecological agriculture.

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