Research on Sustainable Development Path of Ecological Agriculture Industry in Beijing Suburbs——Taking Xibaidian Village, Daxingzhuang Town, Pinggu District as an Example

Siqi Wu¹, Zhi Wang¹ and Yarong Tan¹

¹Institute of Agricultural Information and Economics, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China, 100097
E-mail: wusiqi0110@163.com

Abstract. With the vigorous advancement of rural revitalization policies, industrial prosperity has put forward new requirements for the ecological agriculture industry. Not only requires the provision of higher quality agricultural products, but also promotes the adjustment of the agricultural industry structure. It is necessary to meet the continuous increase in farmers' income and the people's demand for a better life. In recent years, Beijing suburban agriculture has achieved good results in green production, rural energy and agricultural leisure construction. However, there are still problems such as being greatly affected by raw materials, low operating economic income, and insufficient technical equipment. In this paper, the three development models of eco agriculture in Xibaidian village are analyzed. Construct a sustainable development path for the ecological agriculture industry in the suburbs of Beijing from the development concept, development mechanism and new industrial formats. Promote diversification to build a rural complex in Beijing, and realize the harmonious unity of ecological protection and farmers' income increase.

1. Introduction
Since the Rural Revitalization Strategy was put forward, Beijing has carried out rural construction with the blueprint of "prosperous industry, livable ecology, civilized rural style, effective governance, and affluent life". Implement rural industry integration around new business forms in rural areas, integrate scientific and technological elements and humanistic elements into agriculture, and create a rural ecological industry chain such as ecological tourism and ecological planting and breeding[1]. The Ministry of Agriculture and Rural Affairs has also promulgated the National Rural Industry Development Plan (2020-2025) to guide localities to focus on the integration of natural resources and urban and rural construction, accelerate the upgrading of rural industries, and promote the coordinated development of production and life.
In the Rural Revitalization policy, industrial prosperity is the foundation, and ecological livability is the key. The eco-agricultural industry can effectively play the green production function of agriculture and guide technological upgrading to upgrade the processing industry. At the same time, it can also integrate rural leisure tourism projects to achieve industrial integration development [2]. Ecological agriculture is a multi-level, high-level circular agricultural system based on modern agriculture, with ecological protection functions. The ecological agriculture industry should combine social, economic and ecological benefits. It is a structure that builds the harmonious development of man and nature [3].
The development of the ecological agriculture industry in the suburbs of Beijing has four major advantages. First of all, it has resource advantages. It has the advantages of natural scenery, characteristic agricultural brands, historical sites and scientific research talent resources [4]. Integrate it into the development of ecological agriculture industry to realize an industrial chain integrating scientific production, ecological circulation, and entertainment science. Second, it has a sound policy guarantee mechanism. Beijing has good policy support and scientific and technological support in the fields of ecological agriculture, circular agriculture and clean energy. There is also a relatively complete grassroots management system in rural governance, and organized management in the form of a party branch has strongly promoted the development of agricultural modernization in Beijing. Third, in terms of transportation location, Beijing is located in the integration of Beijing-Tianjin-Hebei and the Bohai Rim Economic Circle, with a good location foundation. At the same time, the north-south train tracks and two large international airports provide Beijing with good tourism market advantages. Fourth, Beijing farmers have strong initiative. Beijing farmers can correctly understand the importance of ecological protection and the forward-looking nature of ecological agriculture. They also have strong action in rural environmental governance. They can give full play to the main consciousness of farmers to promote the construction of new agricultural formats.

This paper discusses the current situation of ecological agriculture in Xibaidian Village. Study the dilemma of its industrial development and the development path of different models. The author hopes that this paper can provide references for building ecologically livable villages and beautiful and healthy agricultural industries.

2. Development of ecological agriculture in Xibaidian

2.1. Natural resources and the current situation of the agricultural industry

Xibaidian Village is located in Daxingzhuang Town, Pinggu District, in the Northwest Plain. The daily temperature range and the annual temperature range are relatively large, and it is dry and less rainy. The four seasons of Xibaidian Village are vivid and enjoyable for viewing. Xibaidian Village is located in the Ruhe River Basin, with an average annual rainfall of 644 mm and relatively abundant groundwater. The frost-free period is about 180 to 190 days. The annual average sunshine hours are 2555.3 hours and the average sunshine rate is 58%. The natural resource conditions of Xibaidian Village can meet the growth needs of a variety of flowers. The village has convenient transportation. It is 1 km from Shunping Road to the south, 0.5 km from Cuixing Road, 0.3 km from Xiyan Road, 10 km from Jingping Expressway, and 7 km from Pinggu City to the east, which is convenient for attracting urban tourists to visit and rest.

Xibaidian has sufficient agricultural labor and has a good industrial development foundation. The village covers an area of 1,048 mu and more than 800 acres of arable land. Based on the positioning of Pinggu’s Capital Ecological Conservation Area, and with the planning concept of “ecological establishment and green development”, Xibaidian has become one of the first beautiful and smart villages in Beijing. Build an ecological agricultural industry system that focuses on animal husbandry, flower planting and biogas energy industry.

2.2. The main problems in the development of ecological agriculture in Xibaidian

2.2.1. Adjustment of Production Structure and Dilemma of Biogas Industry Development.

In accordance with the requirements of Beijing’s policy of sorting out and promoting upgrading, as well as the increase in the cost of aquaculture industry and the decline in aquaculture income, the planting structure of Xibaidian Village has changed, putting great pressure on the supply of biogas raw materials. According to Beijing’s remediation action, 90 buildings exceeding the standard illegal construction were demolished, and the rectification area reached 5000 square meters. The scale of poultry farming in Xibaidian Village has been drastically reduced due to policy requirements such as protected water sources and relocation. As the main source of manure for the biogas project, the Xibaidian livestock and poultry breeding industry has suffered a supply chain break.
In addition, there is no specialization for further production and processing of biogas residue and biogas fertilizer. On the one hand, due to insufficient biogas station equipment and the failure of automated equipment; on the other hand, it is also limited by the training of technicians and lack of fertilizer sales channels.

2.2.2. The operational development of rural biogas industry is limited.

With the development of the biogas industry, the biogas project must not only solve the problem of villagers' gas use and disposal of waste from the breeding industry, but also build a production cycle system and form an effective market profit mechanism.

Due to the implementation of projects such as the conversion of coal to electricity in Beijing and the West-East Gas Transmission Project, the existing biogas supply has been reduced from the original 6 villages to two villages, and the reduction in the amount has caused an excessive output of biogas products. This phenomenon not only caused a waste of resources, but also caused a certain degree of equipment idleness. At the same time, due to historical reasons, there is no natural gas pipeline in Xibaidian Village, and the villagers will still supply biogas as the main method. However, with the overcapacity of biogas production, now only one gas tank needs to be opened to meet the needs of the village. To solve the problem of overcapacity, the export and commercialization of biogas must be developed.

On the other hand, there is a lack of effective planning for the development of the biogas industry. The first-phase biogas project only pays attention to the supply of biogas in the process design, but lacks cogeneration and biogas fertilizer design. Although the second phase of the project introduces the separation technology of biogas residue and liquid, it can achieve a reasonable output of organic fertilizer and formula fertilizer, but the degree of commercialization of its terminal products is still relatively low, and the technical level of the operators is still lacking. There are also shortcomings in product commercialization. The fertilizer is mainly for self-use and return to the field, and the sustainable operation capacity is insufficient.

In summary, with the adjustment of Beijing's rural animal husbandry structure and energy consumption structure, the biogas industry must be upgraded in terms of energy supply and industrial chain construction.

3. Xibaidian ecological agriculture industry development effect

3.1. Xibaidian ecological agriculture cycle model

3.1.1. Gas and fertilizer co-production model.

Beijing occupies an important position in the development of biogas industry. From the promotion and application of small household biogas digesters in rural suburbs of Beijing in the 1970s and 1980s [5], to the construction of small and medium biogas projects in the early 21st century, and the large-scale development in 2006, it has gradually taken shape. Xibaidian Six Village Joint Biogas Station is a comprehensive biogas station, it has a 2020m³ energy ecological biogas project. It uses USR technology for medium temperature fermentation, including 2020 m³ anaerobic fermentation tanks, 200 m³ high-pressure biogas storage tanks and other equipment. It is also equipped with comprehensive utilization facilities such as biogas and biogas residue. So far, 832 households in Xibaidian, Zhouzhuangzi, and Liangzhuangzi villages have been co-supplied. The biogas slurry pipeline leads to the planting area of 162 solar greenhouses, making it a healthy and high-quality ecological organic fertilizer. The biogas project has achieved zero discharge of pollutants, turning waste into treasure, meeting the needs of the people's production and living, and providing them with cooking and water, reducing living costs [6]. According to calculations, the average annual cost of biogas per household for a family of five is about 300 yuan, which is 700 yuan less than burning coal for cooking, and 800 yuan less than using liquefied gas. Each household saves 1.5 tons of coal each year, Xibaidian Village saves 330 tons of coal each year, reduces carbon dioxide emissions by about
1,000 tons, reduces emissions by more than 2 tons of sulfur dioxide, and reduces emissions of nitrogen oxides by about 1.5 tons. The effect of energy saving and emission reduction is very obvious.

The second phase of the project refines the biogas slurry and biogas residue using a gas-fertilizer co-production model, with an annual production capacity of 20,000 tons of organic fertilizer, providing high-efficiency, low-cost, high-quality organic fertilizer for the greenhouse planting industry, and ensuring the quality of crops. A "pig-methane-fertilizer-vegetable" ecological cycle agriculture model has been formed (Figure 1), realizing the cyclic development of high economy in planting and breeding, high efficiency of gas fertilizer, clean rural environment, and ecological agriculture.

![Figure 1. Schematic diagram of gas fertilizer co-production biogas project.](image)

3.1.2. “Eco-Bridge” model

Faced with Beijing’s efforts to sort out and promote upgrading, as well as the structural adjustment of the livestock industry, the lack of raw materials for biogas, and the lack of labor and the decline in biogas utilization rate due to the urbanization process. The idle phenomenon of some biogas projects is prominent, and the construction of supporting biogas projects in individual villages is difficult. The grassroots village-level management method also lacks effective management experience, which leads to the unsustainable development of the biogas industry.

In response to the above problems, Pinggu District has established an "ecological bridge" treatment project to collect farmers’ straw waste (Figure 2). The government will lead the establishment of a resource treatment center for agricultural and forestry wastes jointly with enterprises and townships. These wastes will be processed in a centralized manner, through the steps of crushing, fermentation, and biogas reaction to produce organic fertilizer. The converted fertilizer is then sent back to the farmers for planting. The large-scale agricultural cycle model of the entire Pinggu District can process 77,000 tons of agricultural and forestry waste and produce 45,000 tons of organic fertilizer every year. This model also innovatively incorporates the farmers’ points management system into the cycle, and incorporates the civilized behaviors of farmers into the points system, such as garbage sorting, voluntary service, and three packages at the door to accumulate points. Then exchange the points for agricultural materials and daily necessities through the point management system. This model fully mobilizes farmers' enthusiasm for participating in environmental protection, encourages farmers to develop the habit of planting with organic fertilizer, and ultimately accelerates the construction of local ecological agriculture. In addition, Xibaidian, as a pilot village for “garbage not landing” in Pinggu District, adopts a dual-track combination of cleaning staff's door-to-door garbage collection and farmers' initiative to put garbage. It promotes the active participation of villagers and gradually raises villagers’ awareness of ecological protection. The "Ecological Bridge” cycle model integrates rural life into ecological construction and agricultural production, and comprehensively promotes the construction of clean and beautiful villages.
3.2. "Xiliang Zhou" ecological garden industry model

Daxingzhuang Town, with the party branch as the core, unites the three villages of Xibaidian, Liangzhuangzi, and Zhouzhuangzi, with chrysanthemums, roses, and leisure calligraphy and painting as industrial features, and builds a rural complex of "Xiliang Zhou" based on the 2020 World Leisure Conference. With the branch as the organizational structure, the industry as the development feature, and the ecological protection as the new business form, the construction of ecological manors will expand the agricultural leisure and health functions and the village ecological protection functions. Xibaidian Village is the country’s largest edible chrysanthemum base. The village develops ecological sightseeing agriculture with edible chrysanthemum as the leading industry. There are currently 60 edible chrysanthemum greenhouses with an annual output of about 1,000 kg each. In 2018, the Sightseeing Picking Garden occupies more than 60 acres, and the homestay receives more than 20 households. With the introduction of technological means such as the intelligent Internet of Things, the sales income of edible chrysanthemum growers has increased to more than 60,000 yuan per household. Each facility greenhouse also provides farmers with 30,000 to 40,000 yuan income from picking and sightseeing. After the cleaning and renovation of the greenhouses in 2019, under the guidance of the government, the village built 121 standardized greenhouses to create a comprehensive pastoral model of planting chrysanthemums in winter and watermelons in summer. In 2020, under the "Pingyuan" boutique hotel brand in Pinggu, the “Juyuan” brand will be established to develop the rural tourism industry. In summary, a comprehensive development model for the chrysanthemum industry has been formed(Figure 3). This model uses cultural creativity to lead the development of new agriculture, build a chrysanthemum museum, hold a chrysanthemum festival, and create a series of chrysanthemum leisure industries from picking chrysanthemums to chrysanthemum appreciation. In addition to agricultural production, the village created a chrysanthemum processing industry and a chrysanthemum health service industry, forming a unique Xibaidian cultural brand. The industrial integration model promotes the diversified development of rural ecological agriculture and rural garden landscape.

3.2. "Eco-Bridge" Centralized disposal and utilization mechanism of waste resources

Figure 2. “Eco-Bridge" Centralized disposal and utilization mechanism of waste resources
4. Sustainable development path of ecological agriculture in Beijing suburb

4.1. Establish a new concept of sustainable development of ecological agriculture
First of all, to promote the sustainable development of ecological agriculture in the suburbs of Beijing, it is necessary to expand the new concept of agricultural ecological function, from a single agricultural ecological green production function to a diversified ecological barrier function and ecological life governance function. Strengthen the role of agricultural industrialization and commercialization concepts in sustainable development, and develop agricultural ecological leisure functions on the basis of protecting the ecological environment. It can not only promote the development of rural economy, but also meet people's entertainment needs for the rural environment, and enhance the sense of gain and participation of the farmers.

Secondly, focus on cultivating the awareness of the main status of farmers. The main force of rural ecological protection and governance is farmers. We must cultivate farmers' awareness of ecological agriculture, publicize environmental protection policies such as clean energy and human settlements, and actively guide farmers to develop relevant ecological agricultural operations.

Third, strengthen the quality control of ecological agricultural products, improve quality from the germplasm link, save energy and reduce emissions from the planting link, and carry out safety traceability from the product link. At the same time, strengthen the informatization construction of ecotourism, ecotourism and other peripheral products, such as establishing an effective evaluation mechanism for picking and boarding projects. Timely supervision and rectification actions can not only further improve the environmental quality, but also help establish the brand effect of the entire village.

4.2. Constructing the mechanism innovation of ecological agriculture
In order to guide the long-term development of the ecological agriculture industry, it is necessary to build a complete innovation development mechanism. Establish a tripartite interaction mechanism among the government, platforms, and farmers.
First, strengthen the government's guiding function, give full play to the role of policy incentives, use government information release and technical support as planning guidance, use government
procurement, consumption promotion and other financial means as leverage, and use supervision and acceptance as guarantee to build a complete system. On the one hand, it builds a viable ecological recycling agricultural compensation mechanism, on the other hand, it attracts social capital and new business entities to carry out ecological agriculture development and innovation.

The second is to take advantage of the regional platform, break the "small and scattered" development pattern, build a regional ecological brand, and follow the overall design and planning of the entire industry chain. On the one hand, it ensures the overall planning of the production capacity of the ecological recycling industry, and makes overall plans for the types of agricultural production in various regions. Collect scattered planting and aquaculture product wastes in a centralized manner, and then return to the fields to form a large regional cycle. On the other hand, strengthen regional brand awareness and operation and maintenance management and service integration capabilities. Relying on the platform to establish a service system for information communication, technology development, and management evaluation, to avoid the waste of resources caused by blind development, and to further supervise the ecological evaluation capabilities of producers in the region to ensure the establishment of brand effects.

The third is to give full play to the construction of the mainstay status of farmers' ecological governance and to promote the development of farmers' characteristic management. The sustainable development of eco-agriculture must insist on the unshakable status of farmers as the dominant player. First, farmers must recognize the concept of ecological environmental protection and the harmonious development of agricultural economic income. Second, we must vigorously promote the leading role of professional cooperatives or leading enterprises, organize farmers to learn new technologies, and encourage farmers to practice ecological agriculture technology. Guide farmers to develop eco-tourism accommodations, catering and other peripheral products in an orderly manner, and revitalize rural labor.

4.3. Promote innovation and upgrading of ecological agriculture industry

The improvement of science and technology is an important driving force for the development of ecological agriculture industry. In the face of the adjustment of the planting and breeding structure in the suburbs of Beijing, new requirements have been put forward for the development of ecological agricultural industries such as increasing land yield, intensive use of resources, developing clean energy, and protecting the ecology. First, promote the transformation and upgrading of rural clean energy development structure. To cope with the plight of the biogas industry in the suburbs of Beijing, it is necessary to further increase the input of scientific and technological resources, expand fermentation raw materials, improve fermentation efficiency, and increase the added value of biogas fertilizer products. The transformation and upgrading of the biogas industry will drive the large-scale development of ecological recycling agriculture in the suburbs of Beijing. And use this to reverse the impact of biogas energy on the treatment of livestock pollution and the research on the carrying capacity of the treatment of straw waste, and promote the formation of a complete ecological service function in the industry.

The second is to promote the innovation of the development model of the ecological agriculture industry, combining agricultural production, clean energy supply and ecological protection, forming a scientific and technological team to guide and implement the transformation of scientific and technological achievements. Solve the problem of separation of production-fermentation-returning fertilizer in the original small-scale biogas digesters of farmers and some small and medium-sized biogas projects, implement a regional integrated management model, and carry out standardized fermentation treatment with the centralized treatment of agricultural waste in the area as a link. And promote the cultivation of environmental protection behaviors such as family life management, garbage disposal, and toilet revolution in the big cycle, and give full play to the social service value and environmental protection function of ecological agriculture. Ultimately, promote the scientific development model of interoperability of multiple elements and concentration of resources, and further improve the upgrading of ecological agricultural products. Promote the development of ecological landscape and green life based on clean energy ecological planting and breeding, and enhance the core competitiveness of ecological agriculture.
The third is to promote new forms of ecological agriculture industry. To deal with the problem of the lack of operationality of the ecological agriculture industry, to accurately grasp the market prospects, it is necessary to consider the use of recycling agriculture for waste treatment and the provision of clean energy, ensuring the ecological production function of recycling agriculture, and taking into account the economic benefits of the ecological agriculture industry. It is necessary to increase technological investment, strengthen cogeneration and product upgrades. It is also necessary to implement eco-tourism and leisure projects, give full play to the function of ecological protection, take rural landscape and cultural inheritance as industrial development points, and form a new type of business that combines agriculture, culture, tourism, and ecology. In the future, it is necessary to further promote the combination of rural industrial revitalization and beautiful rural construction, extend the ecological agriculture industrial chain, and increase farmers’ income.

5. Conclusion
In the context of rural revitalization, we will vigorously develop ecological agriculture based on industrial prosperity. It is necessary to change the combination of ecological agriculture functional cognition and regional development positioning to break through the small and scattered circular structure. Construct an ecological industry development system guided by the government, innovative by the platform, and dominated by farmers. Promote the development of industrial integration, take the road of sustainable development to realize the construction of rural complex in the suburbs of Beijing, and effectively promote the modernization of agriculture and rural areas.

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