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Economic Research on Ecological Environment of Frigid Region with Black Earth

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Abstract Suihua City in Heilongjiang Province is located in the heart of the frigid region with black earth and it has created abundant green property resources. However, the environmental issue of this place has caused wide attention, so the government should make full use of various means to solve the environment problem and protect the ecology in this region. Among the measures taken by the government, the tax means is the most effective economic device to solve the environmental problem. Economic means supplemented by lawful and administrative measures should be adopted to solve the ecological environmental problems in the frigid region with black earth.

Key words Frigid region with black earth, Suihua city, Ecological environment, Economic means

Black earth in the frigid region refers to alpine black soil with deep and rich humus layer in humid and semi-humid areas of cool temperature zone. The content of organic matter in black earth is about ten times as high as that of yellow earth, so black earth is the most fertile agricultural land, with high soil cation exchange capacity and base saturation. There are three region having the alpine black soil, namely the Mississippi River basin with 1.20 million km² of black soil, Ukraine Great Plains with 1.90 million km² of black soil, and the Hulan River basin of Songnen Plain in south-central Heilongjiang Province, China (1.0185 million km²), and the last one is the heart of the optimal frigid region with black earth in the world. Suihua City in Heilongjiang Province is located in the heart of the frigid region with black earth, so it can make full use of the black earth to develop black earth economy marked by green agriculture, ecological agriculture and brand agriculture and to produce featured products based on the black soil. At present, the economy in the frigid region with black earth has been paid more attention to all over the world^[1]. However, as the exacerbation of ecological environment in the frigid region with black earth, the economy has lost living conditions and space, so good ecological environment is the key to the development of the economy. In addition, to develop the economy in the frigid region with black earth, it is necessary to value the construction of ecological environment in the frigid region with black earth and protect black earth resources in the frigid region.

1 Status quo of ecological environment in the frigid region with black earth of Suihua City

In 2004, Suihua City was given the title of "the home of featured agricultural property in the frigid region with black earth of China", and the frigid region with black earth has created rich property for the society based on its advantaged natural resources and

environment. Under the effects of the black earth brand, Suihua City speeds up the construction of green food base and establishes standard system for green products, so products in the frigid region with black earth are going out to the world. Meanwhile, rural material input, technology application, industrial development and farmers' quality of Suihua City have been improved greatly and accepted by the international market gradually. However, high consumption and low utilization have resulted in waste of resources at the same time, and there are many problems in the construction of ecological environment in the frigid region with black earth now, which have limited the economy development in this region.

1.1 Serious environmental pollution in rural areas During the industrialization development in rural areas, the application of large amounts of pesticides, fertilizer and plastic film as well as indiscriminate discharge of sewage have led to serious water and air pollution, land desertification and decrease of land capability. During the industrial development in rural areas, large quantities of enterprises with high energy consumption and heavy pollution emerged in townships and have brought serious damage to soil, water, animals and people in the frigid region with black earth. In addition, sewage, foul air and pollutants discharged from cities have moved to rural areas. In Suihua City, arbitrary discharge of human and animal excreta, domestic garbage and waste as well as casual straw burning have polluted the atmospheric environment and threatened the ecological environment in the frigid region with black earth.

1.2 Severe pollution of black earth As the black earth has been reclaimed year by year, species and quantity of pollutants in the black earth have been increased gradually, and soil pollution has become more serious day by day. Meanwhile, chemical and physical characters of the soil have also changed obviously, such as increase in volume weight of soil, decrease in water and fertilizer retention capacity and ventilation performance, soil hardening gradually, poor arability and decline of ability to resist drought and flood, which affects normal growth of crops. Soil pollution can be divided into three groups as follows. The first one is organic

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pollution caused by pesticide residue. Over standard rate of pesticide residue in main agricultural products in China reaches 16% – 20% , threatening food safety. Meanwhile, white pollution caused by agricultural plastic film has become more serious day by day, because it is difficult to degrade agricultural plastic film that can release environmental hormone to pollute the environment and affect farmland irrigation^[2]. The third pollution is caused by agricultural production. For example, the application of large quantities of agricultural chemicals has polluted farmland, agricultural products and water; large-scale intensive production of animal husbandry has also polluted water. Due to long-term pollution and unreasonable use, the thickness of black earth has been reduced by 0.4 – 0.5 cm every year, and it has been decreased from previous 60 – 70 cm to current 20 – 30 cm in some regions. Black earth with thickness of 1 – 2 cm will be formed in 300 – 400 years^[3], and the black earth polluted will developed into yellow earth at last.

1.3 Decrease of soil nutrients and fertility To use less input to obtain more output, farmers adopted predatory mode of operation, so that nutrient and organic matter content in the black earth have reduced, and thereby soil fertility has been declined year by year. In 1958, organic matter content in the black earth of Suihua City was 4% – 6% , even reaching 8% , but it decreased to 3% – 5% in 1990, and it was below 2% in the region suffering serious soil erosion^[4]. Meanwhile, with the reduction of organic matter content in the black earth, nutrient storage, fertilizer preserving capability, crop yield per unit area and crop quality have also declined.

1.4 Underutilized straw and methane tank In a long term, Suihua City has paid more attention to grain use than straw utilization, so large amounts of crop straw has been left with the development of agricultural production and rural energy business. For instance, the straw accumulated on a road can not only block traffic but also pollute the environment. Crop straw can be changed into methane, which can not only reduce soil pollution caused by parasites but also decrease the application of pesticides and fertilizer. Besides, the residue of methane fermented can be used to control 23 crop diseases and 24 pests, and its control effect is equivalent to that of pesticides used at present^[5]. According to statistics, area of farmland, forest land, grassland suitable for grazing and water surface available to breeding of Suihua City was 16 433, 6 640, 5 153 and 1 513 km² respectively in 2012. In 2011, the certification area of green food reached 10 353 km², accounting for 63% of farmland area, ranking first among prefecture-level cities in China. In addition, number of animals raised in Suihua City accounted for 20% of total number of the province, and yield of economic crops like cured tobacco, flax and beet ranked first in the province. Moreover, Anda City, Qing'an City and Lanxi County of Suihua City are the homes of milk cow, green food and flax. As regional characteristics of the frigid region with black earth have been shown day by day, its economy has emerged. However, the eco-environmental problem of Suihua City has re-

stricted the implementation of the plan building " the home of green property in the frigid region with black earth " , which is adverse to the harmonious development of our economy and society.

2 Measures to solve the problems in ecological environment of Suihua City

In the market economy, each economic unit may suffer market failure when pursuing maximization of their own utility and environmental pollution is an exterior problem caused by market failure. To solve exterior problems in economic development, British economist Pigou proposed that the government could use tax means to adjust pollution behavior and make up for loss of resources caused by pollution and pollution control cost in 1920, and the application of ecological tax has been supported by countries in the world. Besides economic means, lawful and administrative measures should be adopted to solve the ecological environmental problems in the frigid region with black earth.

2.1 Adopting economic means to control ecological environmental problems in the frigid region with black earth

2.1.1 Imposing environmental pollution tax on pollutant discharge behavior in the frigid region with black earth. It is necessary to levy environmental pollution tax on excessive pollutants caused by the application of pesticides and fertilizer as well as consumers' behavior leading to environmental pollution, so as to reduce the application of pesticides and fertilizer. Suihua City, a big agricultural city, has 16 433 km² of farmland, and large amounts of fertilizer, pesticides and plastic film have been consumed every year to pursue the maximization of land yield, but the behavior has led to environmental pollution, so the government ought to levy a certain tax on consumption of these articles to reduce their application. That is, related department should determine the minimum application rate of fertilizer and pesticides in the black earth and levy a tax on them according to its minimum application rate, so as to prolong the useful life of the black earth. In the frigid region with black earth, based on international experience, environmental pollution tax should be levied on enterprises discharging pollutants into rural areas according to pollutant discharge, such as soil and atmospheric pollution tax, aiming to promote these enterprises to improve pollution control technology. In addition, the difference between conventional fertilizer or pesticides and biological fertilizer or pesticides in tax rate should be set up to encourage farmers to use green products and enhance competitive power of green products. According to the practice of western countries, levying environmental pollution tax on pollutant discharge behavior can not only make full use of resources but also protect ecological environment.

2.1.2 Putting land use tax into resource tax. In Suihua City, farmland resources in the frigid region with black earth have decreased in quantity and quality at present due to farmland occupancy and expansion of urban districts in some regions. Hence, the government ought to adopt means to restrict land occupancy.

2.1.2.1 Incorporating land use tax and farmland tax into current

resource tax. The government should levy resource tax on land occupancy to improve land use cost, and the tax should be higher in the frigid region with black earth, so as to reduce farmland occupancy and waste of black earth.

2.1.2.2 Establishing financial compensation mechanism for black earth resources Special funds should be applied to the state and government to protect black earth, and compensation funds for black earth resources should be set up to increase the investment in farmland protection in the frigid region with black earth. Meanwhile, the government should give economic subsidies to farmers to encourage them to protect current farmland, and they can sign a land use contract with the government^[7] to determine the environmental objective realized by farmers and subsidy provided by the government.

2.1.2.3 Strengthening comprehensive utilization of methane. The government ought to encourage farmers to build methane tanks and give them financial subsidy. Soil pollution caused by parasites in vegetable field with a methane tank can be reduced by 60% – 80%, and methane tanks can dispose human and animal excreta to decrease rural environmental pollution. Biogas manure produced by a methane tank with volume of 8 m³ in a year is equal to 50 kg of ammonium sulphate and 15 kg of potassium chloride, so it can reduce the application of pesticides and fertilizer in the frigid region with black earth. Therefore, learning from the construction experience of methane tanks in developed areas, the government should vigorously develop the construction of methane tanks in Suihua City to protect the ecological environment in the frigid region with black earth.

2.1.3 Protecting rural source of drinking water and levying water pollution tax. Drinking water of Suihua City has been polluted seriously by human and animal excreta and domestic waste, and the accumulation of fertilizer and pesticides in drinking water and soil has threatened human health. To control water pollution, the reasons for water pollution must be found out. Like Netherlands, Sweden and USA, the Chinese government should levy water pollution tax and protect source of drinking water to improve quality of drinking water gradually.

2.2 Using legal means to solve ecological environmental problems in the frigid region with black earth It is necessary to strengthen legal construction to solve environmental problems in the frigid region with black earth. America issued and implemented *Soil Protection and Domestic Quota Law* in 1936, and then implemented *Farmland Protection Plan* in 1962. In Holland, discharging manure on the ground surface is illegal. Learning from the international experience, land and environmental management departments of Suihua City ought to establish related regulations and policies to solve ecological environmental problems in the frigid region with black earth, such as rural environmental protection law and soil protection law^[9].

2.3 Adopting administrative measures to manage ecological environment in the frigid region with black earth Administrative measures to manage the environment include registration system, establishment of standards and bans and permit system.

In Suihua City, the government should adopt administrative measures, such as registration and permit system of producing and selling fertilizer, and the production and sale must be stopped when pollution happens. Meanwhile, the government should strengthen the management of pesticides damaging soil nutrients and human health and establish strict registration system, and high-efficiency, innocuous and low-residue pesticides should be popularized to avoid environmental pollution and ensure safety of agricultural products. Among EU countries, Sweden registered above 500 pesticides again in 1987, and only 60% of pesticides were permissible; these pesticides were checked again in 1991^[10]. The government of Suihua City should learn from the international experience.

3 Conclusions

Depending on advantaged geographical environment, Suihua City has created abundant green property resources, but the environment has been destroyed and threatened the development of green property resources in the frigid region with black earth, so the government should adopt effective measures to solve ecological environmental problems in the region. The state should fully survey agricultural environment in the frigid region with black earth and adopt effective measures to improve current situation, develop ecological, organic and water-saving agriculture based on rural industrial structure adjustment, and develop organic, green and pollution-free food. Meanwhile, the government should adopt economic means supplemented by lawful and administrative measures and encourage the public to protect ecological environment in the frigid region with black earth.

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