The Research Based on the 3-R Principle of Agro-circular Economy Model-The Erhai Lake Basin as an Example

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Abstract

The agro-circular economy is the sustainable development strategy, which based on reduce, reuse, recycle principle (referred to as the 3-R principle) and including green agriculture, ecological agriculture, sustainable agricultural. There are many issues of agricultural in Erhai Lake Basin, the industrial structure is single, the layout is unreasonable, the ability to resist the market risk is weak, and Non-point source pollution is serious and so on. In view of this, it is urgent to implement agro-circular economy development model: energy comprehensive utilization pattern, ecological breeding pattern, agriculture waste comprehensive utilization pattern, agricultural eco-tourism pattern etc.

Keywords: 3-R principle; agro-circular economy; Erhai lake basin


1.1 Theoretical Analysis and Application of Circular Economy

Circular economy is a new sustainable economic growth mode, take the resources highly effective use and circulation use as a core, take reduce, reuse, recycle (referred to as 3R) as the principle, take low consumption, low emissions, high efficiency as characteristic. So-called reduce have three connotations in economic production: First, reduce material, water and energy input; Second, reduce product manufacturing which most people originally do not need; Third, in does not reduce the quality of life, reduces people's demand. So-called reuse also has three aspects: First, take a thing multi-purpose; Second, develop with waste as raw material remanufacturing industry; Third, uses the renewable resources

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substitution non-renewable resources as far as possible. The recycle is the same with the former two, also have three aspects: First, take the wastes of raw materials become the enterprise interior materials circulation; Second, building technology park; Third, constructing circular economy system different from traditional, realize resource recycling utilization. So, the essence of cycling is a clean closed-loop flow mode by establishing resources-production-consumption-waste reuse system, with as little resource consumption and environmental costs to achieve maximum economic and social benefits, ultimately achieve the impact on the ecological environment to minimize, and economy, society, environment inter-coordinated sustainable development.

The circulation economy first has obtained the success in developed country's industrial system. In the enterprise level, has the example of DuPont Company success to utilize the 3-R principle to realize clean production, the economic efficiency and the environment benefit are remarkable; In region level, the most famous example is Denmark's Karan fort eco-industrial park, which forms through enterprise's industry metabolism and the co-existence relationship; In national level, the country put forward and put into practice earliest is Germany and Japan, both of countries are making great strides forward to the recycling society.

In recent years, the circulation economy also caused great attention of the Chinese government. At present, China has in Yunnan Erhai, Guangxi Guigang Guangdong Nanhai, Inner Mongolian Baotou, Xinjiang Shihezi, Hunan Changsha and other areas has carried on the experiment site, has made some progresses. But generally speaking, the circulation economy in China is still newly emerging things, even if in industrial field, also was only just started. So, in the agricultural field, there are fraught with difficulties. But this does not mean that the circular economy is difficult to make progress in agriculture, on the contrary, the agriculture need vigorously developing circular agriculture which take the ecological agriculture as the foundation.

1.2 Agricultural Circulation Economy

Is opposite says in the traditional linear agricultural economy, the circulation agricultural economy is the material closed-loop-flowing economy. It is refers to the upper level (or lateral) of waste generated during production of agricultural products into the next level (or lateral) of raw materials for production, make the whole product process to achieve interconnected organic link ring, not produce or extremely few production waste material. This requires the full use of material carefully. Biomass includes animals, plants, microbes and their derivatives, feces and body, and one of the biomass energy. Each raw material in the circular economy is an integral part of agriculture, is the interaction, mutually the agriculture circulatory system which forms for the circulation current economic condition's different material combination. Agricultural development of circular economy, compared with traditional agriculture, the biggest difference is that resources conservation and recycling (Figure 1), is the way of modern agricultural production technology of a revolution.
According to China's agricultural circulation economy practice, mainly formed the following three theoretical modes: First, the multi-industry development mode, is to study land management unit in the same three-dimensional cultivation, horizontal extension, construction the integration of agriculture, forestry, animal husbandry and fisheries model. Second, ecological protection type development mode, it is the ascension and ecological agriculture integration based on, and mainly studies how the modern technology with traditional agriculture through appropriate investment, make the ecological system of agriculture on maintaining the ideal status and can keep good material energy circulation, thus achieves the coordinated development of man and nature. Third, agricultural waste recycling-based development model, this is the most typical model, mainly study the waste disposal after use in the process of agricultural production, to achieve set energy, environmental protection, resources reuse. In this paper, the author will take the Erhai lake basin as the example to research how to developing the agricultural circulation economy.

2. Analysis on the Pattern of Erhai Lake Basin’s Agro-circular Economy

2.1 Development Status and Constraints of Erhai Lake Basin

Erhai lake basin has rich natural resources, plenty of water resources, and superior agricultural production conditions. So, the agricultural production resultant with an average annual growth 6.05%, grew from the 1.137 billion Yuan in 1999 to 1.934 billion Yuan in 2008, is the most important agricultural production base in Dali state. But this does not mean that the agricultural development of the basin has been no problem, on the contrary, the problem is very prominent. First, the agricultural structure is single; the ability to resist the market risk is weak. In this basin, the proportion of planting and animal husbandry industry of economic output accounted for 94%, while the proportion of forestry and fishery production value of only 6%. In addition, in the planting, the concentration is very high, concentration is also high. Take Eryuan County as the example, in the Dam area, the garlic sown area amounts to 50600 mu, accounting for more than 90% of the whole region. Secondly, the layout is very scattered. Valley animal husbandry industry were 36067 raisers for two, but most of them the family breeding, 50 heads above large-scale only 16 dairy farms. Finally, agricultural pollution is very serious. Excess fertilizer and pesticide inputs, livestock manure emissions to the water environment have a tremendous impact, resulting in excessive levels of nitrogen and phosphorus in Erhai Lake. Therefore, in order to fundamentally resolve the problems mentioned above, we should promote the ecological agriculture, circular agriculture and agricultural facilities construction vigorously.

2.2 Development Mode analysis of Erhai Lake Basin’s Agro-circular Economy

According to the analysis of the agricultural industry in Erhai lake basin, the author believe, the agro-circular economy's development must in the existing resources condition and in the industrial superiority foundation, uses the following several patterns to realizes breakthrough.

2.2.1 The pattern of energy comprehensive utilization—the efficient use of biogas as the example

In shortage of energy countryside, the farmers not only burning down crops straw stalk and poultry excrement for heating and cooking, but also cut down trees massively, serious damage to the environment. Erhai lake basin agricultural leading industry is planting and animal husbandry industry, we should give full play to their superiority, establish a link to the ecological chain by establish multiple links with the biogas. Simultaneously, take biogas as center to build the cycle network between farming and animal husbandry, become disadvantage for advantage, forming high-yield, high-quality and high-efficiency
agriculture; it’s a positive eco-agricultural model to realize agriculture raise animal husbandry, livestock to add fertilizer, fatty change the land and increasing grain yield. [2] Figure 2 is the schematic diagram of its industrial chain.

2.2.2 The pattern of ecological breeding —— the cow cultivation as the example

The circulation agriculture's technical core is the ecological technology, therefore, the ecology cultivation project is the key point of building circulation agriculture, was deciding the effect even success or failure of the cycle agriculture. [3]

According to the survey, the cow is the unit area pollution withdrawal and the pollution emissions total quantity largest agriculture industry, moreover, the breeding scale expanding rapidly, brings threaten seriously for this basin water environment. Therefore, establishing ecological breeding pattern has the extremely vital significance for this basin. Figure 3 is the schematic diagram of its industrial chain.

2.2.3 The pattern of agricultural waste comprehensive utilization—— with garlic straw for example

In the Erhai Lake basin, the garlic planting is only limited to plant-sales model, the deep-processing products are very few, a lot of waste generated has not been fully utilized, a lot of garlic stalks discarded by the farmers, not only affecting the agricultural landscape, but also polluting the river and lake.
Therefore, should be reuse the garlic stalk by the highly effective organic fertilizer factory, realizes the garlic stalk's circulation use. Simultaneously, realizes the garlic industrial development and the basin environmental protection. Figure 4 is the schematic diagram of its industrial chain.

![Figure 4](image_url)

**Figure 4** the schematic diagram of agriculture waste comprehensive utilization pattern

### 2.2.4 The pattern of agricultural eco-tourism

The modern agriculture not only has the production function, but also has the life function which for the people the sightseeing, the leisure and take vacation. [4] This pattern take the agricultural production as the foundation, use of agriculture natural environment and humanities environment, take the agricultural production, the agricultural life and the ecological environment as one to develop tourism industry, forms the multi-purpose ecology agricultural park which collection of science researching, producing, sales, funning, sightseeing, consulting and holiday as one. Figure 5 is its industrial chain schematic drawing.

![Figure 5](image_url)

**Figure 5** the Schematic diagram of agricultural eco-tourism pattern

### 3. Summary

The pattern of agro-circular economy is the agricultural sustainable development strategy, which based on the 3-R principles and enables the agricultural superiority resources to use fully; it is an inevitable trend in the development of modern agriculture. In the Erhai Lake Basin, there are many issues of
agricultural development: the industrial structure is single, the layout is unreasonable, the ability to resist the market risk is weak, and Non-point source pollution is serious and so on. Combined with the actual situation of Erhai lake basin, choose the energy comprehensive utilization pattern, ecological breeding pattern, agriculture waste comprehensive utilization pattern, agricultural eco-tourism pattern etc, is helpful in control the agricultural non-point pollution from the source and build a resource-saving and environment-friendly Erhai ecological agriculture.

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