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Innovating and promoting the traditional dike-pond system in China

Agricultural development must take constraints of resources and environment into account. As a kind of Stereoscopic Agricultural farming mode, dike-pond system smartly uses the relation between creatures and energy to form an efficient and environmental-friendly agricultural harvest cycle. This paper studies the dike-pond system from three aspects: what is the dike-pond system, how to make it more useful for us, and why we need to study it.

Agriculture plays an essential role in food safety, environment protecting and benefits of the country. However, as a country people more than 1.3 billions , China has a limited agricultural resources per person. Moreover, with the trend of industrialization and urbanization, the occupation of agricultural resources makes it worse for farmers. Since the reliance of primary industry on the environment is the most tremendous among those of the three sectors, the appearance of updated Eco-friendly agricultural methods is extremely urgent. The dike-pond system, which is valuable in fields of material, energy and economics, is a Chinese traditional method worthy to be referred.

The research of the dike-pond system took place early in the Pearl River Delta. It has been recorded in the <Shunde county annals>, the <Nanhai county annals>, and the <Jiujiang village annals>. According to recent research, the pond agriculture is an Eco-friendly agriculture which does planting, aquaculture and processing industry utilizing the water-land system formed by the dike and pond. The traditional form of agriculture appeared in Ming dynasty and was greatly spread in the Qing dynasty and caused the research climax in the 1980s. Starting from the 1950s, the academia has done several major researches on the dike-pond system. Then in the 1980s, the geographic institute of Guangzhou explored the dike-pond system and the Land and water interactions through the locating observation method and Semi locating observation method. From 1980s, western scholars have also focused on the system adapted in the Pearl River Delta. In 1992, UNESCO named the dike-pond system a typical example of regional agriculture development, which incurred more attention to the system in the world. Numerous scholars have dug into the topic from aspects such as ecology, spatial framework, and the material-energy flow.

Firstly, the traditional utilization of the dike-pong system is worth discussing.

The mode of agriculture recycling economy was formed in the East-Tiaoxi river valley in Huzhou plain in the 17th century. The indigenous had been employing the circular agriculture until the 1970s. Focusing on the Hydrological characteristics, this dissertation describes the agricultural environment, and discoursed the basic structure of the dike-pond system which involved the planting and utilization of aquatic plants and mulberry, fish management of the ponds and the feeding of Hu Yang-sheep. The dissertation also analyzed the typical ecological techniques in the district.

The lake area appears to lean against south from the lakeside of the tai lake; the east and west Tiao stream join at the south of Huzhou and flow into the Tai lake. The East Tiao stream flows calmly but it is easily robbed by the West Tiao stream of the entrance to Tai lake. As a result, the water does not discharge easily, which forms flood quite often. In that case the clever indigene digs deep into the flooded pools and uses the soil dug to form the dike for planting mulberry trees, and what's more, the resourceful farmers use the leaves to feed silkworm in seek of producing silk to sell. This was the rudiment of the dike-pond system^[1]. The planting, weaving and aquaculture form a peaceful ecosystem around the East Tiao River district and then the Pearl River Delta.

The Wang family has survived for more than 300 years adopting the traditional dike-pond system and would best demonstrate the brilliant ideas included in this seemingly simple way of production.

It is important to understand the use of pond to fully comprehend the system we are talking about. It is a subsystem that establishes and protects the aquarium environment. The ponds are in different shapes, such as rectangle or circle, which are corresponding to different usages of the pond. There are generally four uses of the pond: designed for krills, parent fish, food fish, and all fish. The difference of fishes decides that the pond tree needs to be different to fit the particular type of fish. For example the carp needs for the convenience of breeding and spawning. Also the size of the ponds varies as the number and age of the fish is different. It is most common for the ponds to be 0.5 hm², and the depth of the pond for the grown-ups is mostly 3-6 meters, the babies 2 meters.[1] ¹In addition, some of the farmers would fertilize their ponds by using the dried grass or the droppings of animals and human.

The mulberry trees are another main reason that the Wangs adopted this kind of agricultural procedure. As we all know, the main export of China used to be silk and won China a good fame for its wonderful quality. Therefore, many people in southern china used to devote themselves to the chain of silk production. So the leaves of the mulberry trees and the food of the silkworms appears to be extremely important and plays a great part in the farmers' profit. People fertilize the tree using the droppings of the farm animals and the mud in the ponds which contains the leftovers of fish. Every August and December, the Wangs would clean the ponds and transfer the mud to the dike, where the trees live on. It is a win-win activity for both the pond and the dike. It helps the dike to be more fertile while the pond becomes clearer, deeper and better for the growth of fish. Also the sun helps to kill most of the diseases and bacteria in the pond that has been used for more than half a year.

The shape of the dike is worth discussing. Its intersection surface is mostly the shape of a trapezoid, for it is the best shape to fully utilize the fertilizer. That shape ensures that the fertilizer given to the ground surface would not be wasted if washed off, and may even give back the fertilizer to the pond where the fish live in. Thus, it helps the mulberry trees to extend their root deeper into the dike, which will make the trees grow better and give more leaves. Adopting this kind of method, the local farmers would easily enhance and raise the productivity of the dike-pond system.

<1>Construction Committee economic survey statistics written: <Chinese economic history-wuxing, Zhejiang>twenty-fourth year of The Republic of China, page64

The Hu Yang goat is another main source of income for the Wangs. Using the left leaves and trunks trenched from the trees and the aquatic plants, it is easy for goats that have been domesticated for more than 500 years to grow faster and healthier. The kids mostly take this job as a member of family and the group. They would normally cut grass and gather leaves in autumn when the leaves are about to fall and the grass to perish. These kinds of food contain the maximum of carbon hydrate and the goat fed would be plump enough, wool-producing, and easy to breed. Also the fertilizer the goats give would be perfect and nutritious for the mulberry trees, therefore, every family keeps several goats to produce meat and fertilizer since it is easy to breed the goats and their meat are delicious to eat.

After all, the fundamental base of the system developed in the East Tiao area is the convenient and outstanding environment. It provides the dike-pond system with essential materials and energetic source which are stable and unbreakable. Thus, the rivers and lakes form an aquatic environment for the ponds to operate. All this form a high level of agriculture

Secondly, modern innovation of the tradition would bring the system to live.

Through scientific planning and design, modern sightseeing agriculture ecology system should have a variety of functions including serving as ecological agriculture demonstration, tourism site, organic farm, popular science education and agricultural science illustration program, so as to realize the combination of ecological benefit, economic benefit and social benefit.

As an ecology agriculture demonstration, the system serves as a perfect illustration for farmers outside the East-Tiaoxi area.

Sightseeing agriculture ecology garden design USES a variety of ecological agriculture pattern layout. The purpose is through the ecology principle, to help the country build up a rational utilization of natural resources, maintain ecological stability and sustainable and efficient agricultural ecosystem, improve agricultural productivity, get more food and other agricultural and sideline products. Besides, the productivity in rural areas that adopt the system would be raised and they can set good examples to other areas. It is important to the Chinese agriculture because we are now feeding 22% of the people using 7% of the world's land. This system would give several ways to produce more agricultural products and to increase the farmers' profit, as it is apparently low at this moment.

As a tourism site, the system serves as a place of relaxation.

Sightseeing agriculture ecology garden planning, being about agricultural production, makes full use of rural landscape, the local ethnic customs and local culture. The system will be based on natural ecological aesthetics gardening techniques, allowing the development of agricultural and sideline products and tourism products with distinctive features. When formed, the dike-pond system garden will be suitable for sightseeing, tasting, shopping, and holding many activities such as farming, leisure, vacation and it will form a distinctive "sightseeing agricultural tourism garden" As the Chinese are growing richer and are willing to travel outside of their hometown, a tour in the traditional Chinese agriculture garden would be a great choice. And the wonderful scenery in the countryside and the hospitality of the indigen would give them both pleasure and satisfaction.

As an organic farm, the system serves as a great provider of green foods.

As organic food consuming has become a world trend, the ecological garden should deepen the plan of the organic agricultural product production. It is important to produce clean and safe food through the organic cultivation and to transfer them into organic food which will eventually form a brand. And as Chinese are growing more and more concerned with food safety, it is important not to produce foods that are both bad for the consumers' health and to the farmers' reputation. Then organic farms will be inviting to corporations and graduates from famous agricultural universities. Catching the trend of organic farms, Chinese farmers with their farms could go further beyond the domestic market and even to the international market.

As an agriculture science education program, the system plays an essential role in providing students vital information of the agriculture and the environment surrounding us..

Through the construction of agricultural museum, exhibition hall in the park, it is possible to form a site for many visitors such as primary and middle school students to carry out environmental education and science education. At the same time the program should meet the needs of the development of Chinese agriculture and try to establish an agricultural technology exchange center and training base in order to reflect the popular science tourism functions of sightseeing and to create a fine image of the tourism products. It is important for students of today to learn and understand the importance of agriculture as a life-supporting industry. And what's more, it is essential for the teenagers to know how the farms work and how the products are made, so that they will not be idiotic when asked questions about the first industry.

As an agricultural industry, the system gives jobs and opportunities.

If the system is set up and the products are sustainable, some factories could be established to provide processing advantage and job opportunities since the productivity has risen and the number of farmers has decreased. The factory is far more than only like a factory anywhere else. It could provide the agricultural district with advantages of convenience and quality of products. With the factories around, farmers do not need to carry tons of products to sell far away in the market somewhat miles from home, or to get up early to harvest the goods. the factories would do all these for you. Furthermore, the surplus labor in some thriving families need not travel thousands of miles away to seek a job in the urban factories when working in the local factory can provide help to the farm and convenience to the farmers.

Thirdly, it would be significant to promote the traditional technology to some countries in need.

As a system that has existed for more than 500 years, the dike-pond system has great variety of modes that could adapt to different environments, and the products could differ from silk to fruits. All these adaptations could form a diversity of farming methods that could greatly help other parts of the world, such as the southeast Asia, to develop their agriculture.

The climate in Southeast Asia and parts of south Asia is mainly tropical–hot and humid all year round with plentiful rainfall. Southeast Asia has a wet and dry season caused by seasonal shift in winds or monsoon. The tropical rain belt causes additional rainfall during the monsoon season. All this make the southeast Asia an area with numerous flooding and excessive precipitation.

This kind of climate, however, is perfect for the dike -pond system to operate. Since the waterfall is enough and the techniques of mulberry planting and silk making have long been taught by the Chinese, the area is a wonderful and blessed place to adopt the technology.

Bangladesh has a tropical monsoon climate characterized by wide seasonal variations in rainfall, high temperatures, and high humidity. Regional climatic differences in this flat country are minor. Three seasons are generally recognized: a hot, muggy summer from March to June; a hot, humid and rainy monsoon season from June to November; and a warm-hot, dry winter from December to February.

Heavy rainfall is one character of Bangladesh causing it to flood every year. With the exception of the relatively dry western region of Rajshahi, where the annual rainfall is about 1,600 mm (63.0 in), most parts of the country receive at least 2,300 mm (90.6 in) of rainfall per year. Because of its location just in south of the foothills of the Himalayas, where monsoon winds turn west and northwest, the region of Sylhet in northeastern Bangladesh receives the greatest average precipitation. From 1977 to 1986, annual rainfall in that region ranged between 3,280 and 4,780 mm (129.1 and 188.2 in) per year. Average daily humidity ranged from March lows of between 55 and 81% to July highs of between 94 and 100%, based on readings taken at selected stations nationwide in 1986.

Each coin has two sides. The flooding that caused many to die may be an advantage for the adoption of the dike-pond system that could benefit the country and reduce the catastrophic effects flooding may cause.

As it is the case in the Southeast Asia and in the South Asia, the farmers could better take advantage by using the system for fishery and crop-growing. In that case, is digging deeper into the pond to try to improve the pond environment and planting rice or sugar cane. These strategies not only help the farmers to reduce loss in flooding, but also let the farmers gain more profit to satisfy the family. In some rainy and mild areas, advantages are the rainfall so therefore the pond could gain them more profit. And in some high-altitude places such as the Deccan Plateau, the dike could be built higher to grow more crops such as wheat or sugar cane. As the system all depends on the land, how it should be developed all depends on the environment of the area.

According to FAOSTAT, Bangladesh, a particular country form the south Asia that is suitable for promotion, is one of world's largest producers of^[i]: fisheries^[iii] (5th), rice (4th), potato (11th), mango

^[1]"FAOSTAT 2008 by Production". faostat.fao.org. Archived from the original on 12 May 2008. Retrieved 6 June 2008.

^[1] Bangladesh becomes 5th largest fisheries producer by FAOSTAT". bonikbarta.com. Archived from the original on 7 September 2013. Retrieved 7 September 2013.

(9th), pineapple (16th), tropical Fruit (5th), onion (16th), banana (17th), jute (2nd), tea (11th). The production of fish and rice could be increased by adopting the dike-pond system It is beneficial for the farmers, since this method could provide them with more profit than simply fishing and farming. And it is also beneficial to the businessmen, since the system could provide a plentiful of opportunity to start factories and form industries that brings profit form the domestic and even the world market. It is also beneficial to the government, since the rise of productivity means the increase in taxes and a rise of reputation in the world.

Each year in Bangladesh about 26,000 km², (around 18%) of the country is flooded, killing over 5,000 people and destroying more than 7 million homes. During severe floods the affected area may exceed 75% of the country, as was seen in 1998. This volume is 95% of the total annual inflow. By comparison, only about 187,000 million m³ of stream flow is generated by rainfall inside the country during the same period. The floods have caused devastation in Bangladesh throughout history, especially during the years 1966, 1987, 1988 and 1998. The South Asian floods in 2007 also affected a large portion of Bangladesh. However, the dike-pond system formed in the pearl river Delta is one agricultural system that is designed to prevent the floods. With the ponds to hold water and prevent floods, the trees and plants on the dike consume the water in a significant speed, which prevents the farmlands from flooding. In the long term, the ponds could act as adjustments to the excessive rainfall, which could save many lives.

The dike-pond system, acting as a traditional Chinese agriculture system, which plays an essential role in the agriculture of the pearl-river Delta, will play an even more important role in the future and will eventually be widely spread in China and other places beyond China. The special procedure will affects many lives and hopefully benefits many lives.

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