

## BIONOTA

### MODERNIZACIÓN DE LA AGRICULTURA

#### AGRICULTURE IDEAS AND MODERNIZATION OF AGRICULTURE

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##### RETROSPECT OF AGRICULTURE

The development of agriculture has its own history from primitive agriculture, traditional agriculture to modern agriculture. Is it a historical road we must follow?

Human being had experienced a long history of living on collection and hunting for about 2,000 to 3,000 millenniums since human being appeared on earth. After we settled down, another 10 millenniums passed. Human being began to cultivate crops and raise animals. Thus, we entered the primitive agriculture stage. The primitive agriculture lasted for 7,000 years to get our food security on primitive crop cultivation and animal raising.

As the accumulation of knowledge of agriculture production techniques, the traditional agriculture replaced the primitive agriculture. The traditional agriculture lasted for 3,000 years. Its basic characteristics are: fine tillering, combination of use of land and maintaining its fertility, in line with local conditions, integration of crop plantation and animal husbandry, diversification, to protect natural resources, to oppose fishing by draining lakes, to prevent diseases and pests by traditional ways from affecting their natural enemies, to comprehensively utilize renewable energy. But this is a labor intensive, self subsistence, small scale agriculture production with backward technology. It always depends on the hand-out of nature.

Under the pursue of human beings about 200 years ago, agriculture entered the 3rd historical stage, modern agriculture. Its basic characteristics are: mechanics replaced animal draft. Big machine replaced manual instrument. Agricultural chemicals (fertilizers, pesticides and additives) are used to maintain high yields and output. It has caused pollution to environment and consumed large amount of non-renewable energy so it is also being called fossil fuel agriculture. With so high commodity rate and so high agriculture produce, agriculture no longer depends merely upon experiences but on a solid foundation of science.

Although fossil fuel agriculture increased agricultural

productivity so much, but they consumed too much non renewable energy such as coal and oil and caused serious pollution. That is why many new agriculture ideas emerged. In early 1920s, *biological agriculture* emerged in German speaking countries, *organic agriculture* in England in 1930. In early 1970, William Alberkurt proposed the term of *ecological agriculture*. His first intention was to keep good soil fertility in American agriculture production to enable plants grow well and animals grow well in turn. After that, its meaning was extended and became an antonym of fossil fuel agriculture (inorganic agriculture). In the meantime Rodale Farm set up organic agriculture experimental farm. In 1976 International Association of Organic Agriculture campaign was set up in Swiss and the First International Organic Agriculture Meeting was held in Swiss. In 1980 International Biological Agriculture Research Institute approved the direction of organic agriculture and considered that ecological agriculture would substitute organic agriculture. The former Soviet Union and Eastern European countries paid more attention to the management of ecological agriculture and emphasized the functions of rotational grass and crop system and recycling organic matter to fields. In Japan the people paid attention on agriculture management after the WWII and published a book of *Natural Agriculture*. In 1982 under the auspices of East West Environment and Policy Research Institute and the Ford Foundation, SEA University Agricultural Ecological Systems Research Network was established to combine the efforts of 6 universities in the Philippines, Thailand and Indonesia. In 1984 Chinese Academy of Science or Chinese Academy of Agriculture Sciences accepted the concept of *Ecological Agriculture*.

##### CONSENSUS FROM DIFFERENT IDEAS ON AGRICULTURE

On philosophy they believe in integration of nature and human being and realized human being is a part of nature. They advocate

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harmony of nature and human being and intend to reduce interference to nature by human activities. On technology they emphasize traditional agriculture techniques and propose compost, rotational farming systems, leguminous planting, and biological control of agriculture diseases and pests. They exclude man made agricultural chemicals. On management they advocate small scale, self-subsistence and emphasize closed material cycle and negate the input from outside of farm.

Some Chinese scholars considered this kind of idea was just a fashion and would not have great impacts on agriculture production. But their positive meanings are apparent that it aroused the environmental consciousness of the people and rectify the negligence of resources and environment by modern agriculture. Modern agriculture always puts emphasis on increasing productivity and efficiency. On the other side of a coin, organic agriculture over-emphasizes nature and negates the initiatives of human being, opposes to input, opposes to commercial compounds and negates modern science and attempts to realize closed material cycle models. This is a kind of retrogression of science.

Well, the idea of sustainable agriculture happened to emerge in the western world in the middle of 1980s. In 1992 Development and Environment Conference held in Rio Janeiro proclaimed the 21st Century Agenda — sustainable development, which was a milestone. In 1993 International Sustainable agriculture and rural development symposium was held in Beijing. In 1994 the State Council of Chinese government approved China 21 st Agenda — population, environment development white paper. Agriculture and rural sustainable development is one of its topics. Sustainable agriculture gained support from all over the world as a strategic orientation. However, it has not been developed to a perfect technical system. Recently Gunter Pauli proposed the Second Green Revolution as well as FAO in Rome Food Security Convention in 1996.

Under the zero emissions concept, we are now advocating IBS or Ecological Agriculture in China. Ecological agriculture is different from agricultural ecology. It emphasizes application, focuses on economy, not only food chain, but also processing, not only material cycle and energy flow but also money flow, information flow and labor flow. It is not a closed system, but an open system with a balance between systems and environment and social ambiance.

### THE DEVELOPMENT OF ECOLOGICAL AGRICULTURE IN CHINA

In 1981 the 9th report of the Roman Club *Dialogue about fortune and welfare* indicated economy and ecology is a whole entity, which can not be divided. In a world with its ecology damage it is impossible that there will be fortune, wealth and welfare.

The first document of CCP in 1983 indicated that to realize the developmental target of agriculture we must pay attention to

controlling strictly population growth, utilizing rationally natural resources and preserving better ecological environment. Afterwards, these become three well known prerequisites of the development of agriculture. In 1984 the concept of ecological agriculture was accepted by academia circle.

The fundamentals of agricultural ecological economics:

1. To raise the utilization of resources especially bio-resources;
2. The rational deployment of ecological economies with reasonable structure;
3. Adaptability in lines with local conditions, adaptable each other between ecology and economy;
4. Optimization with better economic benefit and ecological benefit;
5. Planning according to ecological, economic and social benefits

Ecological agriculture can be divided by its scale of administration into four:

1. Ecological county
2. Ecological town
3. Ecological village
4. Ecological household

Ecological agriculture also can be classified by its functions into 7 levéis:

1. Great watershed harnessing program.
2. Small watershed harnessing program.
3. Intensive management model, to raise the utilization rate of produce and by products, not only multilevel utilization along food chain, but also processing in depth for value added purposes.
4. Stereo planting and culture model e.g. rice-fish-Azolla, sugarcane-mushroom-fish.
5. Courtyard economy model, to utilize plots and backyard around your house for fruit tree, poultry and livestock raising or by product processing e.g. vermiculture in rural area of Wuxi.
6. Multi-layer recycling model to recycle and reuse of organic matter including straw, stalk, root butts, fallen leave, oil cake dregs, husk, sawdust, residue, animal manure for the aim to maximize economic return according to applied ecological economics. Someone calculated that 50 kg of rice straw could convert to 2.15 kg beef, 0.75 kg of fish, 60 kg of mushroom, 30,000 kilocalorie energy and 60 kg of high effective fertilizers (N, P, K) through multiple recycling system.
7. Organic waste enlarged recycling engineering eco model, that is the extension and enlargement of the above model to turn wastes into materials of value. It means the establishment of this compound ecological model will bring out the development of feed processing industry, food industry, energy industry, building material industry, transportation industry in rural area.

Three Rivers and Three Lakes Harnessing Program, Reforestation Program in the upper stream and middle stream of the Yangtze River or Reforestation Program in three Northern

Parts of China are the national level Ecological Agriculture Programs.

Now let's talk about small one and give you an example. Small watershed serves as a basic developmental unit from the top of a mountain to the bottom of a valley. The land suitable for forestry should be used to develop forestry. The flat land suitable for crop planting will be used for plantation. The grassland suitable for animal husbandry will be used for grazing. In production practice, inter-cropping between wood and grain or rotational cultivation of grass and cereal crops and integration of crop cultivation with animal husbandry are adopted. In this structure wood and grass may be the bulk of the ecosystem. The system must have multi-layer space structure so that the accumulation rate of absorption of solar energy will be the highest. According to data analysis, the biomass of forestry and grass occupied 50% of the total production of biosphere on earth, and its accumulated biomass occupied 90%. If forestry and grass are dominant part of local agriculture, animal husbandry could convert and reuse the accumulated biomass and it will extend the food chain and promote the coordination of the development among biome. That will strengthen its self adjustment capability to any intrusion from outside. This endogenous potential will be put into full play to reduce soil erosion, enrich the soil, rehabilitate the ecology with the results of increased production. This will realize a benign circulation in ecology, biological production and economic return respectively and among themselves.

A Case in Helong Village, Nancheng County, Jiagxi Province

Before 1980, there were no trees on top of the mountains, the area of soil erosion reached more than 400 hectares, which accounted for 73% of the total land in this village. The rice production was only 6 t/ha. In 0.133 ha fishpond, the fish production was less than 30 kg. There were 370 pigs in pigsties. The income was US\$ 25 per capita in the village. Then:

- They combined the harnessing of soil erosion with agricultural development. They planted orange, peach, plum trees and inter-cropped cash crops such as peanut, watermelon, and mung bean.
- They combined the harnessing with enclosed mountains for reforestation nursery about 100 ha and they planted wood belt along the river to protect it and planted grass 1.5 ha and preserved a restricted zone of 200 ha.
- They combined biological measures with engineering measures to prevent soil erosion. In ten years they built 60 sandbanks and dug 10,000 fish scale pits and 30 km ditches round the mountain. This accelerated amelioration of low yielding fields. Up to 1989, waste hilly land was reduced by 77%, vegetation coverage increased by 78% and effectively harnessing soil erosion. The grain production reached 11.6 t/ha, the orange production 100,000 kg, and the plum 1,000 kg. The pig number in pigsties increased to 894 by the increasing rate of 591%, fish

5,000 kg with an increase by 92%. The production value increased from US\$ 3,600 in 1981 to \$ 114,000 in 1989. The income increased to US\$ 81 per capita with a net income \$ 50.

### **WHY DOES ECOLOGICAL AGRICULTURE DEVELOP WELL IN CHINA?**

It is because from the beginning, eco agriculture was combined with the structure adjustment of industries in rural areas and with efforts to increase farmers incomes.

Farmers have welcome the economic benefits brought by eco agriculture.

Some scholar proposed intensive sustainable agriculture and considered it will be the road of modernized agriculture in China. We allow hundred of flowers blossom. Professor Liu Shenhao from China Agriculture University expressed his view on the main contents of intensive sustainable agriculture:

- to install agriculture with modern industry for realization of mechanization, electrification, chemicalization and water conservancy,
- to apply modern science and technology,
- to manage agriculture by using modern economic management theory and to substitute commercial economy with open systems for traditional self subsistence economy with closed systems,
- to optimize resources and environment, to protect natural resources and to reduce pollution and finally purify and beautify rural environment,
- agricultural modernization should be performed with industrialization and urbanization of rural areas simultaneously in order to transfer surplus of labor and to increase labor productivity and income of farmers and to narrow the difference between cities and towns.

Well, my comment is this: Agriculture chemicals (inorganic fertilizers and pesticides) have their merits on food security for human being. However, they caused pollution to water, soil and air and seriously destroyed soil fertility and ecological balance. More seriously, stretches of land becomes desert under the continuous bombardment of chemicals. Just as Rachael Carson describes in her book *Silent spring*. The surface humus of soil was composed by remains of flora and fauna and their excreta and microbotic colonies. The soil erosion can not hardly enable us to think of the topic of organic agriculture. In fact, there is much wisdom in ancient agriculture. An English agronomist once said that farmers in China returned all decayed organic matter to the fields. That is why China can support a large rural population and maintain soil fertility as well. The rudiment of organic agriculture is to emphasize the integrity of agriculture. We should build a holistic view of balance and harmony of human being, natural ecology and agriculture.