

# **Ecological Circular Agriculture and Green Development**

## **Forum 3**

### **Green Technology and its applications**



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**Speaker 4**

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#### **Abstract**

(1) Identify the ecological and environmental problems faced by agriculture; (2) Introduce the necessity and importance of developing ecological agriculture and green development; (3) Ecological agriculture model and technology (Recycling of waste resources; biodiversity use; green substitution and reduction of chemical inputs, greenhouse gas mitigation etc.); (4) Policy and law regulation.

Hello, My name is Kunzheng Cai, come from Natural Resource And Environment, South China Agricultural University, China.

Today, I will discuss about ecological circular agriculture and green development, including four parts. First is some problems related to conventional agriculture, second is how to transform from the conventional agriculture into ecological agriculture, the third is some examples for the ecological agriculture technologies, and the last is some policies and law regulation for ecological agriculture.

During the decades, Chinese grain production has made great progress, but it is depended on the higher input. For example, high input of irrigation, chemical fertilizer, pesticide, film were used, which led to lot of problem, including environmental pollution, lower biodiversity with monoculture, greenhouse gas emission etc.

For example, overuse of chemical fertilizer resulted soil acidification and environmental pollution. And agriculture is one of the sources of greenhouse gas emission, it contributed more than 10%.

So, what's the green development of agriculture? It is to coordinate “green” with “development” to realize the transformation of current agriculture with high resource consumption and high environmental costs into a green agriculture or ecological agriculture. It means sustainable agriculture.

There are four levels to transform conventional agriculture into sustainable agriculture. First, we can reduce the input of chemicals and increase the efficiency of resource utilization. Second, we can replace chemical fertilizers and pesticide with organic and biological inputs. The third one, we can design the agroecosystem to increase biodiversity. For example, intercropping, crop rotation, agroforestry etc. The last one, we may reconnect the growers to the consumers and increase the cultural sustainability.

I will give some examples for this conversion.

For biological diversity use, this can be realized at the landscape, agroecosystem level. We can integrate different crops through intercropping according to their ecological niche, effectively use land, light and nutrient. In paddy field, rice can be integrated with aquatic plants and animals, such as vegetables, ducks, fishes etc. We can keep some grass in the fruit garden to increase the biodiversity. But how to realize the mechanization of intercropping, as traditional intercropping needs a lot of labour. There are two different solution methods. First, we can design some specific machine for this intercropping, Japanese scientists have invented some specific machines which can be used in this traditional intercropping. Another method is that we can design the intercropping system which are suitable for the current machine, such as strip intercropping.

For nutrient management, we can integrate irrigation with fertilization and use liquid fertilizer, thus reducing the water and fertilizer input, increasing nutrient utilization efficiency. And we can apply new type of fertilizers such as controlled-release fertilizers with coating materials and biochar-based fertilizers to increase fertilizer efficiency.

For waste recycling in agroecosystem, we can use biogas to connect plant and animal farming. Animal wastes can be materials to produce biogas, liquid and solid from biogas tank can be returned to the fruit field. These pictures showed a medium fruit garden, poultry farm and biogas tank, biogas was used to connect them.

For soilborne disease control, I will introduce a new no-chemical method called Anaerobic Soil Disinfestation (ASD) to replace traditional chemical control. First, organic carbon sources such as crop straw or rice bran was incorporated into the soil, then irrigation and film mulching were used to create an anaerobic condition to eliminate the soil borne disease. Here we showed the effects of ASD on the soilborne disease control of several crops including strawberry, banana and chilly.

How about the mitigation of greenhouse gas emission from agriculture? We take methane as an example, because paddy fields are among the largest sources of CH<sub>4</sub> emissions. There are some strategies to reduce CH<sub>4</sub> emission, including water management through mid-season drainage or alternate

wetting and drying irrigation, optimizing fertilization, organic input through straw removal, biochar and manure application, and breeding some new water-saving varieties.

In china, there are three kinds of food system, including safe food, green food and organic food. Safe food is the basic requirement for market. Green food has two levels, A level and AA level. Green AA level is close to organic food, but in green A level, some specific fertilizer and pesticide can be used.

Beside the above technologies, policies and laws regulation are also important in ecological agriculture and food system. In ecological agriculture, there are natural, human direct intervention and social and economic regulation to sustain agricultural production. For example, for those ecological sound agricultural practices, some economic methods can be implemented through reducing taxation, government investment and award, reducing interest rate; for those ecologically wrong practices, the methods can be used such as increasing taxation, increasing the charge for pollution and resource, increase interest rate.

So, this is what I want to talk about from the conventional agriculture to a sustainable agriculture.

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