The comprehensive utilization technology of crop straw

Wenhao Wang¹, Zhichao Cheng¹, Qu Cong²*
¹College of life sciences, Heilongjiang University, Harbin 150080
²School of geography and tourism, Chongqing Normal University Chongqing 400047
*Corresponding author’s e-mail: 499081599@qq.com

Abstract: the development of agriculture in our country is related to the economic development of our country, and agricultural development will produce a lot of crop straw. Crop straw is the name for the remains left after the crops are collected. In the north, corn is the most common one. A large number of crop straw burning causes a lot of pollution every year in the autumn harvest season, and damages the soil structure of the land. However, effective and reasonable return of crop straw can greatly increase the fertility of the land and effectively reduce the use of chemical fertilizer. Therefore, the comprehensive utilization of straw is under rapid research in order to effectively use the advantages of straw.

1. Introduction
Straw, as a by-product of grain and cash crop production, is rich in protein, vitamin, nitrogen, phosphorus, potassium, trace elements, etc. it can extract energy, pesticide, food raw materials and additives such as alcohol, bio gasoline, wood acetic acid, wood tar, polysaccharide, carbon products and forage grass, etc. to some extent, the comprehensive utilization value of straw is not very different from that of grain. Taking corn straw as an example, about one ton of straw can be produced per mu of land. Through comprehensive utilization, about 500 kg of compound fertilizer, 400 kg of pulp and 100 kg of alcohol can be produced. It can be said that the comprehensive utilization of straw, from "no burning" to comprehensive utilization to industrialization, will play a "multiplier effect" on China's agriculture and food production, and the resulting social benefits are far-reaching.

Significance of returning crop straw to the field Crop return to the field plays an important role in improving soil fertility and farmland ecological environment, and can increase the content of trace elements in the soil, and at the same time can improve the yield of crops.

2. Comprehensive utilization of crop straw
Crop straw is very rich in China. Among them, straw, wheat straw and corn stover are the three major crop straws in China. Table 1 According to the 2006 China Statistical Yearbook, the 2015 crop yield of grain crops was estimated.
Table 1 Estimation of Total Crop Straw in China in 2015

| types | Grain output / tons | Proportion of primary and secondary products | Straw production / tons |
|-------|---------------------|---------------------------------------------|-------------------------|
| Rice  | 18058.8             | 1:1.0                                       | 18058.8                 |
| wheat | 9744.5              | 1:1.2                                       | 11693.4                 |
| corn  | 13936.5             | 1:1.3                                       | 18117.5                 |
| Beans | 2157.7              | 1:1.6                                       | 3452.3                  |
| Potato| 3468.5              | 1:2.5                                       | 8671.3                  |
| Total | 47366.0             |                                             | 59993.2                 |

2.1. straw returning method
The ways of straw returning to the field include turning over and pressing, covering, burning, over belly and retting.

2.1.1. turning over and returning directly to the field
It is to smash straw and use rotary tiller to turn over and press it to make the rate of returning to the field reach 90%, but straw returning to the field will make the pathogenic bacteria and pests in straw enter into the soil and increase the number of pathogenic bacteria in the soil, which will significantly increase the number of pests in the next year, affect the yield and destroy the balance of the soil biological system, so some drugs should be added to reduce the pests and pathogens in the process of returning to the field. The number of bacteria, although it can reduce the number of pathogens and pests, but the impact on the soil ecosystem is unknown.

2.1.2. straw mulching
The straw is crushed and spread on the soil surface, which effectively reduces the evaporation of water in the soil and the rotten straw provides certain organic minerals for the land, but at the same time, it also makes the pathogenic bacteria and pests enter the soil, making the plant diseases and pests more serious.

2.1.3. straw burning directly returning to the field
It is to directly burn the straw of the collected crops for returning to the field. Although this way saves time and effort and reduces pests and pathogens, it can not avoid the damage to the soil. It will damage the structure of the soil and cause more damage to the land. The burning of straw has caused serious pollution to the atmosphere, indirectly caused a large amount of loss of organic matter in the land, and a large number of smoke particles generated by colleagues’ burning have also caused great harm to human respiratory tract.

2.1.4. return to the field after overeating
Straw is used as feed for livestock. After digestion of livestock, it is converted into manure and urine. Manure and urine are put into the soil for returning to the field, which can greatly reduce the use of chemical fertilizer, reduce pests and environmental pollution, effectively reduce agricultural costs, and promote the healthy development of agriculture. Due to the large coverage of mechanization, this kind of indirect return has been few, and has been taken by direct return.

2.1.5. retting and returning to the field
It is to ferment the crop straw and then return it to the field. The fermentation is divided into two kinds of anaerobic fermentation and aerobic fermentation. Anaerobic fermentation is to stack the straw under the condition of no ventilation, while aerobic fermentation is to stack the straw and establish a vent at the bottom or inside of the pile. The fermented straw becomes a better organic fertilizer. This method can be used to quickly get rid of farming time. Welcome.
2.2. utilization of crop straw in new energy
Crop straw can be compressed under large-scale equipment. The compressed straw can replace the use of wood and coal, and can be used for heating and power generation in power plants, which makes the utilization of straw to a high degree. Biogas produced in the anaerobic fermentation process can be used for heating, reducing the use of coal, reducing pollution and saving energy.

2.3. crop straw as feed
The burning of crop straw will have a great impact on the environment, and the smoke produced will also have a great damage to the respiratory tract of human body, which also wastes a lot of coarse feed of livestock. With the rapid development of animal husbandry in China, the demand for feed is increasing rapidly, so straw is of great help to solve the feed problem. Straw contains a lot of cellulose, which makes the digestibility low. It needs to be processed by various methods to change the structure of cellulose and improve its nutritional value. To return the straw to the field over the belly is to use the straw as feed, so that the straw can be used more widely.

2.4. crop straw as medium
As the base material of edible fungus, crop straw can reduce the input cost, and also make effective use of straw.

3. The importance of straw utilization

3.1. comprehensive utilization of crop straw can save energy
(1) the use of crop straw can reduce the use of fossil fuels. It is estimated that the combustion of 2 tons of straw is equivalent to the heat generated by 1 ton of coal. The development of straw energy can effectively improve the energy structure in rural areas. (2) crop straw is rich in organic matter, nitrogen, phosphorus, potassium and trace elements, which can be used as renewable organic fertilizer in agriculture and reduce the use of chemical fertilizer. (3) cellulose contained in straw is used to replace wood for many industries through biodegradation, which greatly saves the use of wood and protects forest resources.

3.2. crop straw can increase farmers' economic income
In the processing of the original crop orange stalk, only for the convenience of agricultural production in the second year, it can not give full play to the advantages of the utilization of the crop orange stalk, but also has a serious impact on the atmospheric environment, reducing people's quality of life. However, the application of the technology of the comprehensive utilization of the crop orange stalk can realize the rational utilization of the orange stalk. In the early stage, only a small amount of cost is needed to obtain greater economic benefits, which has a positive significance for promoting the production and income of farmers. Especially as feed for livestock breeding, can effectively save the cost of breeding, the economic benefits far beyond the previous breeding benefits.

4. Development prospect of straw utilization
The technology of straw treatment and resource utilization in rural areas is now in a hot stage in China, and the relevant technology is basically mature. At present, the relevant scientific research institutions, colleges and universities, factories and enterprises are stepping up the improvement and optimization to improve the performance, and the prospect of straw treatment and utilization industry is very good. The technology of straw treatment and resource utilization in rural areas is now in a hot stage in China, and the relevant technology is basically mature. At present, the relevant scientific research institutions, colleges and universities, factories and enterprises are stepping up the improvement and optimization to improve the performance, and the prospect of straw treatment and utilization industry is very good.
5. Results and discussion

In order to make better use of straw and promote the development of modern agriculture and rural areas, the first is to establish relevant straw treatment departments. Set up the concept of environmental protection, vigorously publicize the great harm of straw burning and various benefits of straw returning to the field. Set up a model, reward and punishment. Formulate mature straw returning operation plan, issue corresponding straw returning subsidy policy, and encourage farmers to adopt straw returning technology. At the same time, professional and technical personnel were sent to give technical guidance on straw returning to the field through lectures and field operations. Second, we should develop straw returning machinery and equipment with wide applicability. Developing mechanization is the only way to develop agriculture. However, there are many kinds of crops in our country. The physical and chemical properties of different crop straws are different. At the same time, the planting environment of each crop is different. Therefore, the requirements for equipment are different when harvesting straws and returning them to the field. At present, it is urgent to develop the mechanical equipment with the characteristics of high efficiency, low energy consumption, suitable size and wide applicability, which are integrated into the whole system. Third, we need to develop straw in situ return to the field matching rapid decomposition technology. At present, it is still necessary to harvest and crush the straw before returning it to the field. If the straw can be returned to the field in situ, and the rapid decay of straw does not affect the growth process of crop, such as germination and rooting, it will greatly reduce human and material resources. It is necessary to excavate and develop appropriate decomposing bacteria or decomposing agents, so that the change of decomposing rate of straw can meet the needs of nutrients in different stages of crop growth. When the demand for nutrients is high, the decomposing rate is fast, and when the demand for nutrients is low, the decomposing rate is slow. Fourth, we should develop scientific cultivation measures for straw returning. Reasonably arrange the way, time and amount of straw returning to the field, give full play to the maximum role of straw, cultivate the fertility and improve the quality of cultivated land. Scientific application of fertilizers and pesticides will ensure the production capacity of fields and effectively reduce economic investment.

Reference:
[1] Schutz H, Holzapfel P, Conrad R, et al. A three - year continuous record on the influence of daytime season and fertilizer treatment on methane emission rates from an Italian rice paddy field [J]. Journal Geophysical Research, 1989, 94: 16405 - 16415.
[2] Gao BY, Xu Y, Wang Y, et al. Preparation and characteristics of quaternary amino anion exchanger from wheat residue [J]. Journal of Hazardous Materials, 2009, 165: 461 - 468.
[3] Wang XH, Yang HS, Liu J, et al. Effects of ditch - buried straw return on soil organic carbon and rice yields in rice - wheat rotation system [J]. Catena, 2015, 127: 56 - 63.