Study of agricultural waste treatment in China and Russia-based on the agriculture environment sustainable development

Chernyaeva Victoria A.1,a), Xiuyi Teng1,b) and Sergio 1,c)

1 College of Economic and Management, Tianjin Science and Technology University, Tianjin 300222, China.

a) Corresponding author: ch.vika7@ inbox.ru
b) 271018912@qq.com
c) sergiolzfs@yahoo.com

Abstract. China and Russia are both agriculture countries, agricultural environment sustainable development is very important for them. The paper studies three main agricultural wastes: straw, organic waste and plastic waste, and analyzes their treatments with the view of agricultural sustainable development.

1 The agricultural environment of China and Russia

China and Russia are both agricultural countries. Agriculture is very important for their economy, and a lot’s of people are working in the agricultural industry.

1.1 The agricultural development of China and Russia

Within 9,460,000 sq km, China has 13 billion people, there are 77116 people living in city and 60346 people living in rural and countryside. According to Ministry of Land and Resources’ statistic data, there is about 64546 billion sq mi agriculture soil in 2015, at the same time there is about 12000 billion M2 arable land. The main China agriculture productions include: Rice, wheat, corn, beans and potatoes, there are some livestock -sheep, pork and cattle and so on. The China agriculture supplied 87% food, meat, vegetables, fruits and other things for all of the country and it also supplied a lot’s of agricultural products for export. Comparing the past time, China agriculture had changed fast, more and more machines had been used in farming, more and more pesticides and fertilizers had been used, and because of higher Urbanization level and the agricultural relative earnings decline, but the costs rising, more and more young farmers found job in the city so the agriculture development will change from more labors and intensive cultivation to fertilizer, pesticides, mechanized farming.

With 6,592,800 sq km, Russia is the largest country in the world, covering more than one-eighth of the Earth's inhabited land area. As of 1 January 2017, the population of Russia is 144,498,215. Russian agricultural land is 12.9% of the land area, about 220 million hectares, Russia's arable land area is about 125 million hectares, there is also 7260 hectares grassland in Russia. There are about 8.4 million labors engaged in agriculture in Russia. In Russia the main crops include corn, wheat, rice, beans, flax, sugar beet, sunflower and potatoes, the livestock —include cattle, sheep, horse and pork, they produced milk, dairy products and meat. From 1999 to now, Russia's agriculture grew steadily, but it also need import food from other countries. Most parts of Russia’s agricultures are also traditional agriculture now [1].
1.2 The agricultural environment of China and Russia
With the development of economics and the environment had been influenced more and more deeply, the agricultural environment became worse and worse, such as the burning straw makes the air pollution, the spraying pesticides and fertilizers make the soil and water polluted, all of the pollution hurts the health of people and the sustainable development.

China's agricultural environment is undergoing major changes, for the past 40 years, China’s agriculture had change its model form tradition to modern, it had influenced the environment deeply. For there are so huge people need food and the average agricultural area is not enough, so the farmers use too much fertilizers, pesticides, plastic sheeting and hormone so that they can harvest more and more productions. China used a lot of fertilizer and pesticides, excessive use of chemical fertilizers leads to soil compaction, making the soil geological decline, at the same time causing soil, groundwater, surface water and air pollution, China used the most pesticide in the world, and it is 2.5-5 times more than the global average, but only about 20% had been worked, the rest are sprayed into the soil, water and air. There are a large number of straw waste, organic waste and plastic waste. Because there are not good technologies to deal with the straw waste, the farmers choose burning or crushing and then return to the field, the actions result in serious air pollution and pests. The use of plastic film changed the harvest time of vegetables and fruits and increased production efficiency, but it hurt the soil [2].

Russia has a vast cultivated, fertile land, it has excellent conditions for agricultural development. For the traditional farming practices, so Russia has a better agricultural environment. In July 2016, Russian President Vladimir Putin signed a ban on the use of genetically modified technology, in Russia breeding genetically modified animals and planting genetically plant are all prohibited. Russia can become a leading country in eco-agriculture for it has enough natural conditions to produce more green food.

2 Agricultural waste
China and Russia are both agricultural countries, they all plant corn, wheat, rice, sunflower and other crops, feed animals, such as beef, sheep, chicken and pork, and so on. So there are lots of agricultural waste and influence the agricultural environment. In the paper, we will analysis the three kinds of waste and the treatment.

2.1 Straw waste
According to data of Chinese national bureau of statistics and Russian National Bureau of Statistics, China harvested 621,435,000tons food in 2015, grains (corn, rice, wheat, barley, sorghum, buckwheat, oats, etc.) is 572,253,000tons. The total harvest for grains and beans in Russia was 1.2 million tons in 2016. The corn, wheat, rice and sunflower, even cotton, peanut, potatoes, are all have big straw, when the farmers harvest the seed, they need treat the straw. In the past time, they usually burned them as fuel to cook the meal or warm the room or feed them to home livestock, now the fuel change to coal and gas, and the food yields increase intensely, and the fewer and fewer home livestock, the straw become a big trouble for the farmers, so the identity of straw change from useful fuel to waste. In China, the farmers choose burn the straw in the soil or crush the straw and then return and bury them in the soil except they sell them to paper factory or feed mill, however the action made the air pollution or the more pests diseases [3] [4]. In Russia and other countries, the straw usually is used as feed, fuel, compost as fertilize, building materials and making crafts.

2.2 Organic waste
Organic waste is the main types of agricultural waste: the livestock manure; kitchen waste, spoiled feed; rotten fodder vegetable and other waste productions. In 2015, the total output of meat in China was 86.25 million tons, there are 54.87 million tons pork and 7 million tons beef, 4.41 million tons mutton, 18.26 million tons poultry, the egg production was 29.99 million tons. In 2016, Russian meat production reached 9.9 million tons, the pork production reached 3.4 million tons, the poultry is 47 million tons, the beef is 1.65 million tons. So lots of organic waste needs to be treated. Some years
ago, there are not so much chemical fertilize, the organic waste can be use as fertilize after compost. In China, when the chemical fertilize are cheaper and easily used and can harvest more food, the organic waste were given up. They are stacked in field and put into rivers or bury and infiltrate underground [6]. In Russia, even the livestock had been influenced by import, but because it has a large area, so the agricultural organic waste can be digested and absorbed.

2.3 Plastic waste
With the agricultural technology development, more and more chemical and plastic production be used in China agriculture. According to Economic reference newspaper, Fertilizers, pesticides plastic bottles, plastic films, plastic trays and other new agricultural products, not only can improve agricultural production efficiency, but also increase a large number of agricultural plastic wastes. As a result of the recovery system is not perfect, millions of the pesticide bottles, pesticide bags and plastic film were thrown away into the field, resulting in increasingly complex soil pollution. Now there are about 100 kinds of pesticides, divided into pesticides, fungicides, rodenticide, herbicides, defoliants, etc., there are more than millions of pesticide bottles and bags to be drop every year. At the same time, there are more than 500,000 tons of agricultural film residue in the soil every year, they are not easy to break down, and undermine the soil structure, hinder the crop root absorption and growth, which result in groundwater is difficult to infiltrate, when it is broken down, it will pollute soil, water and air. In Russia, the government built some recycle places for the plastic waste, there are also some recycle companies collect the plastic waste, so the plastic waste is not serious for the agricultural environment [5].

3 The waste treatment based on the agricultural environment sustainable development

3.1 Straw waste
According to the research of relative scholar, there are some treatment methods for straw waste: fertilize; solid biofuels; feeding the livestock; building or paper material and straw ethanol or diesel.

Crushing the agricultural straw and compost, then return to soil as fertilize is a usually method to treat straw, it can improve the yield and produce green food. But it need enough places and long time, if it can’t supply a better return, farmers will refuse the method. Now the Russia is better than China to use the method.

The straw waste of agricultural crops (corn straw, sunflower husk, cotton straw, grain straw, etc.), they can be done as solid bio-fuels. The following sheet tell us the calorific value of various fuels:

| Fuel            | Gas          | Coal         | Straw Pellet | Sunflower Husk |
|-----------------|--------------|--------------|--------------|----------------|
| Calorific Value | 8060         | 6000         | 3300-3500    | 3685           |

We can find that the straw has a relative high calorific value. By making solid bio-fuels, the farmers can reduce the cost of fuel, it also can reduce the occupy area for agricultural straw. However, it will have the same problem, people will compare the cost and profit between the gas, coal and straw, sometime, it need the government’s help to use the method.

Some straws are the best feed for livestock in winter, such as sheep and cattle and other herbivore, some green corn straws have lots of sugar and very good for livestock. In Russia the share of grain forage production of feed proportion reaches almost 100%. In china, the ratio is lower than Russia.

With the modern technology, the agricultural straw can be used as building material, it can be made for wall, door, all kinds of plates, people can use them to build house and Furniture [7]. The agricultural straw is also the raw material of paper mill, it can reduce the cutting of trees. Sometimes, they also can be used to make crafts or artwork, such as there are beautiful wheat straw paintings in Tianjin, and there are exquisite straw hats in many places.

The agricultural straw is full of cellulose, it can be used to make straw ethanol or diesel, it can supply some new energy resource and reduce the dependence of oil and gas.
Though the above treatments can solve the pollution of agriculture straw and improve agriculture environment sustainable development, but the cost and value can be considered for the company and the farmer. Now the fertilize, feed, and the paper material are the methods used commonly in China and Russia. The other methods just used by some places and countries.

3.2 Organic waste
The mainly agricultural organic waste is the animal manure; spoiled feed; rotten fodder vegetable etc., agricultural organic waste can’t be used as fertilize directly, and they also can pollute the air, soil and water if they don’t be treated. But if loading organic waste into special containers and overlaps the access of air, they can produce a valuable energy raw material biogas. The gas is discharged into the gas storage and can be used as fuel. The biogas slurry and biogas residue are high quality fertilizes for the soil. And they also contribute to the increase in yield of some crops.

The technology and the special containers need a little higher cost and the fuel are cheaper for farmers and companies, so the biogas just be used in some places in China and Russia. Most agricultural organic waste be used as fertilize directly after composing.

3.3 Plastic waste
The plastic waste is the most difficult for China, every year there are millions of plastic bottle, plastic bag and plastic film be used in agriculture industry, but there are very few recycle places and recycle companies for them. All of them were thrown away in the field and difficult to be decomposition. Now the Chinese government are researching how to recycle and reused the plastic waste. In Russia, there are some government recycle places for the plastic package and some recycle companies also play major roles.

4 Conclusion
China and Russia are both agricultural countries, the sustainable development of agricultural environment is very important for them. The straw waste, organic waste and plastic waste are main waste for two countries’ agriculture. The straw waste can be treated as fertilize, feed, building material, and bio-fuel. The organic waste can be used to produce biogas and fertilize. The Plastic wastes need to be sent to recycle places or recycle companies under government’s help.

Acknowledgments
We thank the help of the Green Loan research team and Financial Risk Management Center of Tianjin University of Science and Technology, College of Economics and Management, Tianjin University of Science and Technology.

References
[1] Zolotarev Alexey Andreevich, Foraponov Alexei, Levchenko Valery Alekseevich, "Current trends and factors of development of agriculture in the region"[J], Vestnik of Kursk state agricultural Academy , 2013(1), pp.112-115
[2] Dou Ying, Deng Yuanjian, Chen Sheng, “Current Situation of Agricultural Environmental Pollution in China and Path of Science and Technology Innovation” [J], Scientific Management Research, 2016(04), pp. 76-79
[3] Sun Ning, Wang Fei, “The Main Uses and Experiences of Foreign Crop Straw” [J], China ‘s population, resources and environment, 2016(05), pp.469-474
[4] Qi Jun, Zhu Liqun, Chen Ligen, Li Qun, “Analysis on Straw Processing Behavior of Farmers in Jiangsu, Zhejiang and Anhui Provinces” [J], Resource science, 2016(06), pp.1099-1108
[5] Cai Jian, “Pesticide Packaging Waste Recycling: Support Attitude and Mode Selection” [J], Economics and Management Research, 2016(12), pp.67-74
[6] Chou Huanguang, Mo Haixia, Bai Junfei, Cai Yaqing, Wang Junxia, “Treatment Methods and Influencing Factors of Livestock and Poultry Manure in China's Rural Areas - An Empirical Analysis Based on Five Province Survey Data” [J], China's rural economy, 2012(3), pp.78-87

[7] Goodhew S, Griffiths R, Woolley. “An investigation of the Moisture Content in the Wall of a Straw Bale Building” [J], Building and Environment, 2004(12), pp.1443-1451