

Wei Zihan
Shijiazhuang Foreign Language School
Shijiazhuang, Hebei
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Introduction of China's cultivated land security and rational proposals

Abstract: Food is the paramount necessity of people, and grain is the principal food. Food plays an important role in social life. Food safety is the primary problem for many people's livelihood and is the basic guarantee of social stability and long-term peace. While the food security must be based on the cultivated land security, China is facing a severe situation of cultivated land security, with little per capita cultivated land and poor quality. This paper analyzes the status quo of China's cultivated land and its causes, and puts forward some proper suggestions for improvement, in order to contribute to cultivated land security in China and even the whole world's food security.

Keyword: cultivated land safety; cultivated land quantity; cultivated land quality; rational proposal

Food is the strategic material of a country, the necessities of life and the basis of agriculture. No food, no stability. Only the basic food and clothing is resolved will the other development be just a castle in the air, so food plays a decisive role in a country. People who produce food are inseparable from land because as the saying goes, labor is the father of wealth, land is the mother of wealth. Cultivated land refers to the land used available to plant crops, it is also the material basis for human life. Effectively protecting, productively using each field and increasing comprehensive productivity are important to ensure the sustainable development of agriculture.

I interviewed Sun Mengxiang and did some simple researches about his specific situation. Sun Mengxiang is from Xingtai City, Hebei Province, China and he is sixty five years old now, he has two sons, two granddaughters and two grandsons and there are ten members in his family. Both of his sons graduated from elementary school and their children are still in elementary school. They rely on wheat, rice and corn as their stable foods. The only food they need to buy is rice. They can be self-sufficiency in food, and they spend little on other foods. As for health protection, Sun grandpa has never been given any fluids, and the physical examination should be at their own expense so they almost never went to have one. The living expenses are about 7000-9000 yuan every year. They grow wheat on August 15th and harvest them in next May (they call it Mangzhong) and then they grow corns and harvest them in 80-100 days. They work outside the home from June to September, the elderly can earn 70-80 yuan/day, and the young people can earn 150-200 yuan/day. They spend about 3000 yuan/hectare on chemical fertilizer and 1500 yuan/hectare on machine harvesting for rice and 600-750 yuan/hectare for corn, and 750 yuan/hectare on machine plowing, and the food subsidy is 30-50yuan/year.

Part one: The cultivated land security status in China

As we all know, China is a country with the largest population in the world. The sixth census data in 2010 show the population in China has reached 1.37 billion. China's land area accounts for about 7%

of the world's, but the population accounts for about 22%, which means the per capita is only 0.8 hectare and it is less than 1/3 of the world average level. China's cultivated land makes up only 10% of the world and the cultivated land per capita is only 0.08 hectare which is less than world's 1/2, just 1/17 of Canada's and 1/8 of America's. The data above indicate that our country is facing a serious shortage of cultivated land. What's more, along with the population growth and the cultivated land decrease, the contradiction between people and cultivated land has become increasingly prominent.

In the autumn of 2003, China's grain market which has been placid for many years released an unusual signal: The low grain prices suddenly went up, with the prices of wheat, corn, rice and other staple food increased sharply in a short time. It was reported that from October 16 to 19, the price of wheat in main producing areas rose by 40 yuan-80 yuan/ton, meanwhile the corn price rose in anti-season. In north China, the corn price rose by 80yuan-120yuan/ton compared with 2002. Rising food prices pulled the flour, rice, edible oil and feed's price. The NBS data showed, in September a clear trend of food price rising appeared, the fresh vegetable prices rose 12%, oil prices rose 7.7%, meat prices rose 5.1%. Experts said it was the first time since 1997 that the product price in large area rose in a short time. This caused attention from all sectors of society, which has become a sensitive topic with varied opinions. Why did the price rise? Is it a one-time or ongoing? The data showed that in 2000 China's grain sown area was 1.07 million hectares, which was 6 million hectares less than that in 1999, the grain output was 462 billion kilograms, 46 billion kilograms less than that in 1999. In 2001, China's grain sown area was 105 million hectares, 2.33 million hectares less than that in 2000, the grain output was 452.6 billion kilograms, 10 billion less than that in 2000. In 2002, the grain yield is 106.3 million hectares, the grain output was 457.1 kilometers, the area and output increased but little. These all showed that the decrease of the food production year after a year was the main cause of rising food price, and the decrease of the cultivated land area year after year is the main cause of decreasing food production. The signal of rising food prices led people's attention to the vast land which is being nibbled. Cultivated land is disappearing!

In 1949, China had 106 million hectares cultivated land, 0.18 hectare per capita. In the 1990s, China had 133 million hectares, 0.1 hectare per capita. By December 31, 2011, cultivated land area was 122 million hectares, population was 1.37 billion people, 0.08 hectare per capita. The data show there is an accelerating decrease in cultivated land.

Sun Mengxiang experienced it a lot. He said, in 1958, each person had 0.07 hectare cultivated land; in 1963, the villagers established 4 production teams, 500-600 person each team, and each team had more than 66.67 hectare land; in 1985 after land redistribution, 0.07 hectare each person (Migrant workers did not have land). In 1995, distribute the land based on the demographic situation, it was still 0.07 hectare person, but at that time, the land sale appeared. In 1995, the price of the land was 1000 yuan/mu, in 1996-1997 was 2000 yuan/mu, the price of the land in 1998 was 90000 yuan/hectare, in 2008 was 1050000 yuan/hectare, in recent years the price is 3-4.5 million yuan/mu. Until 2011, because of roads and urban expansion, farmers in this village lost all their cultivated land. This means 4,000 acres of cultivated land disappeared in just 17 years.

As cultivated land reduced, the cultivated land quality is also suffering a subtle damage. Cultivated land quality directly determines the quantity and quality of the grain harvest, It is not a inferior

cultivated land safety indicators to the cultivated land area. There is 78.5% of cultivated land medium-and-low-yield land, and 37.3% is middle yield land, 41.2% is low-yield land and the high yield land is only 21.5%(the yield per hectare of each one are 7680 kilograms,5445 kilograms and 2085 kilograms.)That is to say, the high yield land we have now is less than 1/3 of the total number, and it is still declining now.

Part two: Threats to China's cultivated land security

The increasing population undoubtedly reduces the per capita of cultivated land in China. But with the in-depth development of family planning, the situation of population explosion has improved significantly. Currently, the main threats to China's cultivated land security are cultivated land decrease and the decreasing quality of the cultivated land.

(No.1)The decrease of cultivated land area

Between 1957 and 1986, we lost 41 million hectares arable area in all and the net reduction is 15 million hectares. In each year, the town expansion occupies 3 million hectares, the township enterprises occupies 0.67 million hectare, non-agricultural construction occupies 0.53 million hectare, soil erosion occupies 0.4 million hectare, farmers buildings occupies 0.33 million hectare, opening Economic Zone occupy 0.2 million hectare, desertification occupies 0.13 million hectare. From 1986 to 2006, the total decrease of cultivated land is 15.3 million hectares. As of October 31, 2006, the cultivated land area in China was 121.8 million hectare. Since the central government strictly enforced "18 billion mu red line" strategy (120 million hectares), the area of cultivated land has not significantly reduced as of today.

The reasons for this reduction in cultivated land are complex and diverse, mainly for the following four aspects:

1. Ecological restoration. Due to the complicated natural reasons, plus years of unlimited mining, reclamation and deforestation, the vegetation coverage rate has fallen sharply in China .Therefore, the government adopted a series of comprehensive ecological restoration measures, after grain for green, a substantial reduction in cultivated land area happened, but this policy can prevent water loss and soil erosion, improving ecological environment and increasing the grain yield at the same time, so reasonable ecological restoration is necessary.

2. Cultivated land occupation by Urbanization Construction. Since reform and opening up, China's economy has been developing rapidly, coupled with fast population growth, and the cultivated land occupation by Urbanization Construction is inevitable. As of October 31, 2006, the land area which was occupied by construction in 31 provinces was 32.3 million hectares. The reasons of land occupied by Urbanization Construction are: urban scale expansion is too large, urban planning is not reasonable, land utilization rate is low and the establishment of development zone is unreasonable, etc. As for the example above about Sun grandpa, his land was mainly occupied by road repairing and estate development.

3. Agricultural internal structure adjustment. Agricultural production is an extremely complicated system engineering. As the forestation, herding and fishing is a whole, the development of grain production must be accompanied by a comprehensive development of forestation, herding and fishing, they promote each other. Agricultural reconstruction taking up part of the cultivated land is inevitable. In addition, because of the low agricultural comparative benefits and the farmers are driven by interests, once has the conditions, the farmers will spontaneously change their land into forestation, herding and fishing ,resulting in decreased amount of cultivated land.

4. Natural disasters destroy cultivated land. Every year in our country there are some natural disasters, including insects, hail and drought which only destroy crops, not cultivated land; geological disasters, sand and flood disasters often damage cultivated land, but few of them cannot recover after a disaster.

(No.2)The decrease of cultivated land quality

Not only the cultivated land area in China is impending red line, but also the quality of cultivated land has serious problems. Reasons to the decrease of cultivated land quality are as following:

1. Compensation land for occupied cultivated land leads superior to inferior. Chinese laws stipulate, if anyone who wants to occupy and use the land, he must give a piece of cultivated land with the same area. But the law doesn't require the quality of the given land, so there is a wide quality gap between the given land and the land which has been taken. The given land is mainly distributed in the area with poor heat, water and terrain conditions, the quality is not high, but the occupied land is usually around the town and near transport and mostly has high quality. The high quality cultivated land is losing fast, the quality of the given land is low, which decreases the quality of China's cultivated land

2. Excessive use of fertilizers. China's chemical fertilizer production reached 29.56 million tons in 1998(net nutrient, similar hereinafter), and it is 19% of the whole world and ranking number One in the world. The actual usage of chemical fertilizer was 38.16 million tons in 1998 and still number One. Although the production and the consumption of our country were the first, it does not mean the way we use is proper. On the contrary, some of the farmers in China can't use them in a reasonable and scientific way, which causes the waste of fertilize resources, increases the cost of farming, declines peasants' income and damages the quality of cultivated land. Using chemical fertilizer will cause the change of soil acidity. Superphosphate, ammonium sulfate and ammonium chloride are acid fertilizer, which means the H^+ in the soil increases after absorbing the nutrients in the fertilizer, and this can easily acidify the soil.

Zhang Fusuo who is a professor in China Agricultural University studied trends in acidification with his colleagues. They compared the soil acid survey results in 1980s' with another one in the past ten years and collected the data of China's agricultural areas over the past 25 years. Finally, they published their report in the US journal "Science". The report says: Since 1980s, the PH value of almost all the soil types has fallen down by 0.13-0.8units. Zhang Fusuo said, this kind of pH value decline usually takes several millions of years. It also causes a lot of trouble. The acid soil is the paradise for the nematodes which can destroy the crops. Besides, some of the soil PH level has been close to the critical value which marks the aluminum and manganese filter to the surface water and

this will be a potential drug sources. It can also dissolve some of the nutrients in the soil. Because of the rainfall and irrigation, the nutrients will recharge the groundwater, which causes the nutrition loss, the soil impoverishment and affects the growth of crops.

Grandpa Sun said 1980s is the most popular time of the fertilizer. Each and every family bought it to improve the production. The output was really improved at first, but the quality of the soil was declining every day. More and more fertilizers were needed and the cost was also increasing. After dozens years, because of the long-term application of fertilizers and without the good care from organic fertilizers, some of the land yield was greatly reduced. Later, the farmers have to change back to use the manure for farming.

3. All kinds of pollution harm the cultivated land quality. The influences of all kinds of pollution on cultivated land quality have different degrees, especially the influence of industrial effluent .Here is an example, Huo Jiaying village is a natural village in Nei Monggol. More than 400 people lived there and the per-capita area of cultivated land was less than 0.27 hectare. Because of the fertile land, many villagers lived by planting and wholesaling vegetables, they were prosperous. However, things changed since several factories were opened. Sewage was discharged into the soil without any warning. It was during the harvest time and lots of crops had not been reaped, so some crops soaked in the sewage and whole village had no harvest. Since then, the cultivated land in Huo Jiaying village has become domestic sewage and effluent's field and the area was expanding. With the guidance of the local villagers, the reporter saw a sewage pipe extend from city to farmland and the sewage between the farmland and houses was everywhere. There were some yellow and smelly drifts floating on the sewage. The depth was between 1.5 meters and 4 meters deep. Sewage not only affects the grain quality, but also affects the quality of the cultivated land. Because of the sewage infiltration, the land which can be cultivated was reduced from 106 hectares to 33 hectares, and the fertile land was less than 20 hectares. Because of the declining farmland, farmers' income became less and less and some people had to rely on credit loans for production and living. Many children had to drop out of school and went elsewhere to work to help with the family expenses. From this example, we can know the sewage extremely effects on the quality of cultivated land, and when the quality affection reaches to a certain extent, the cultivated land area will be effected. Like the Huo Jiaying village, where the farmland decreased from 106 hectares to 33 hectares, and most of the land can not be cultivated. Even though some of it can be cultivated, it was also polluted by inorganic wastewater, organic wastewater, mixed wastewater, heavy metal wastewater, containing radioactive matter water and cooling water with thermal pollution. Do we dare eat this kind of food? So we can see that the sewage not only influences the quality and quantity of the cultivated land, but also influences our food security.

4. Water loss and soil erosion is reducing cultivated land fertility .The land use is unreasonable, especially the irrational development and management of water and soil resources, which destroys the protective mulch and erodes the soil by water which decline the soil fertility and harden the soil. China has a long history of agricultural cultivation, most of the ecological balance has been damaged, and the forest coverage rate is low, some areas is less than 2%. More than 5 billion tons soil loses every year. Severe soil erosion destroys the land resources and declines the soil fertility and production, it seriously affected the agricultural production, especially the grain production. The

calculation shows that only the sediment in Yellow River alone contains millions of tons of nitrogen, phosphorus, potassium and other nutrients each year, most of them come from Loess Plateau . There will be 40-60 kilograms soil lost after producing one kilogram crop. Before the soil and water control, each person only had 250-300 kilograms grains every year, even no grain in suffering year. Water loss and soil erosion damages the integrity of the surface ground, reduces the soil fertility, causes land desertification and fossilized, affects agricultural production, threatens the security of urban area , increases the floods, droughts and other natural disasters, leads people to live in a poor life with poor conditions and hinder the sustainable development of the economic and society.

Besides the chemical fertilizer, soil erosion, all kinds of pollution, drought and salinization also affect the quality of the cultivation.

Part three: Reasonable suggestions to ensure the safety of cultivated land in China

Faced with such a serious cultivated land situation, we should give a high degree of attention to find solutions. Here I put forward several relevant rationalization proposals:

1. To prevent further loss of cultivated land, increase the amount of cultivated land as much as possible, we should take the following measures:

(a.)Plan ecological restoration.(b.)Strictly control the occupation of cultivated land by construction (c.)Intensively and ecologically use the construction land, especially in cities, towns and rural residential land.(d.)Clean up and rectify development zones.(e.)Carefully adjust the agricultural structure.(f.)Improve the ability to withstand natural disasters and reduce the cultivated land loss.(g.) Do a good job in land development and consolidation and reclamation.(h.)Use the roof as a vegetable field, which can not only ease the shortage of vegetables, but also promote the development of economy, and in the face of the disasters, villagers can also use vegetables to save themselves .We should pay attention to the following points: (1) We usually choose the roof which are under six floor or the single-storey houses' roof, and it also should have a certain amount of load-bearing capacity. (2) The soil should not be too thin because the thin soil can't keep the water and its drought tolerance won't be so good, the soil depth should stay around 30 centimeters. (3) In order to avoid being washed away by the downpour, we would better build a parapet wall around the vegetable plot. (4) We should build some drain lines at intervals along the border for draining the water. Besides vegetables, we can also plant some cash crops, such as peanuts and cotton. This kind of roof can not only let people eat the green vegetables, but also form a physical barrier on the roof, which make the room become warm in winter and cool in summer and realize energy saving and lowering consumption, so it is more useful than roof garden; besides, it isolates the effect of environment to the surface skin of the buildings and lengthen their service life. At present, this kind of roof vegetable garden is used in rural area in China, but I am sure that it will be more roof vegetable gardens in city with the development of science and technology and the more attention to healthy food.

2. For the "Compensation land for occupied cultivated land leads superior to inferior "problem. The national people's congress should enact relevant laws to strengthen the land quality requirements of the new lands. We should not allow their occupation unless the developers give a piece of land with

the same area and the same quality. It can not only protect the quality, but also the quantity. The farmers themselves should also have the awareness of rights. If the developers want to give them a piece of worse land instead of a good one, they can charge the developers to protect their rights, This demands a better-off legal system to support.

3. We should adopt the reasonable fertilizer application method.(a.)Don't excessively use the same fertilizer for a long time. Using the same chemical fertilizer will cause one kind of nutrition be exorbitant and then influent the restricted nutrition factor can not be improved and cause the excessive use of chemical fertilizer without the improvement of the output. According to the absence of soil nutrients, we can change the chemical fertilizer regularly to improve the output with little measure, so then decrease the total mount of chemical fertilizer.Use it with proper time, frequency and quantity. Using layered fertilization and deep fertilization is also good methods to reduce fertilizer loss and improve the utilization rate of fertilizer. (b.)Use the organic fertilizer and chemical fertilizer to protect the soil fertility, improve utilization ratio of fertilizer, decrease the water and soil loss and prevent soil compaction. (c.)Invent more harmless and low cost fertilizers to protect the soil and decline the cost. (d.)Enact laws and regulations to prevent fertilizer pollution, and promulgate fertilization standards for pollution agriculture products, so that the use of fertilizers in agricultural production will be rule-based, and have effective control of chemical fertilizers on soil, water and agricultural produce pollution.

4. For "Industrial wastewater pollution damage cultivated land quality" problems. First of all we should combine the industrial structure adjustment with weeding out industries (products, production capacity). Adjust the factories which are high energy consumption, high material consumption, high pollution and resource-consuming. Such as papermaking, dyes and pb-zn smelting. These kinds of industries wastewater is hard to control because of difficulties in tackling, high investment and high operation cost. To strictly control the scale of these industries, we would better produce them only to meet the domestic demand and ban exports, or rely on imports. So we can limit it by making stricter environmental management system, approving project more strictly and having processes. Second, we should promote higher standards of emission and promote deep governance. It means we should improve the correlation technique by increasing processes, adopting the key technologies and enhancing the removal efficiency. In the meantime, we ought to recycle the industrial wastewater and reuse it, develop the advanced treatment and low-emission technologies.

5. To prevent soil erosion. (a.)Plant more trees and grasses, and pay attention to adapt to the local conditions. (b.)Improve the grassland vegetations, graze reasonably and protect meadow. (c.) Keep the topsoil in mines.

6. For the soil which has been polluted with damaged fertility, we can take the following measures. (a.)We can use manure. Manure is the most natural and harmless fertilizer, it can maintain the contaminated soil and it is also very cheap and easy to get. But because of the harmful substance, such as microbe and parasite eggs, and its causes, such as some biological pollution and influences of food security, we should use it after the harmless disposal.(b) We can also rotate the crops rationally, because hold the crop residues can improve the fertility of soil. Just as the rotation of wheat and maize in North China, it can not only improve the fertility of soil, but also decrease the air pollution by the

burning of straw. (c) Use the biodegradation and plants to absorb harmful substances. Many creatures are born medical experts and they can always help the soil a lot. For example, earthworm can improve the soils' self-purification ability. It can handle the municipal refuse, industrial waste, pesticides, heavy metals and other harmful substances in the soil. Therefore, it is called "Ecology of Hercules" and "Purification". In addition, we can grow some non edible plants in the seriously polluted soil, such as flowers, trees, fiber crops and some other plants which are inedible and have heavy metal uptake ability. For example, the species of Fern Asplenium have strong abilities to absorb the heavy metal in the soil, and cadmium absorption rate can reach 10%. Years of continuous cultivation is able to effectively reduce the cadmium content in soil.

7. As for our students, we can establish some communities about cultivated land security as well as have some introduction conferences to introduce the situation of cultivated land security and then we can find some solutions by discussing.

In summary, in the face of such a severe situation, we can't relax and we must persist in the strategy of sustainable development. Try to improve the quality and quantity of cultivated land, thus we can ensure the food's quality and quantity.

China's food security is closely linked to the world's. If China can't be self-sufficient in grain, it is certain that we will seek food supply from the world. But because of the large population, the world food market certainly cannot guarantee the supply of enough food. This would affect the supply to other countries which need help, and leads to food tension .It could even causes national civil strife, breed terrorism and some other adverse consequences. Therefore, the decline of cultivated land quality and quantity is not only China's problem, but also the world's problem. China's cultivated land safety is of vital importance to the world's peace and development. Accordingly, we should establish and strengthen the communications of the technology, talented person, fund and information between China and the world. Wish our people on this beautiful planet no longer be threatened by hunger and food security and live in a happy life together!

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