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China: The Overuse of Chemical Fertilizer in Weibei Plateau and How to Solve the Problem

Weibei Plateau, which is the main grain producing area in Shanxi Province, has relatively fertile soil, abundant sunshine and heat resources, but shortage of water resource. According to the statistical data in recent 15 to 20 years, there is a growing gap between the grain yield of per hectare of this area and that of the whole nation, and its food security based on the grain yield of per hectare is in an urgent need of a leap-over and a breakthrough. The winter wheat-summer maize rotation system is the main Planting System for food producing in Guanzhong and Weibei areas. In this rotation system, the soil fertility mainly depends on the application of chemical fertilizer due to the reduction of the family feeding livestock in recent years and some other factors. The overcharge of fertilizer and the unreasonable utilization structure are the main two factors which become obstacles for the agricultural production.

The hometown of my politics teacher lies exactly here. (Fu Ping County, the birth place of China's present chairman Xi Jinping. He once was sent to live and work in the north of Shanxi prefecture as a member of a production team.)

There are four people in the teacher's neighbor's family--father, mother, child and grandmother. The father graduated from junior high school, the mother--primary school, the child--junior high, the grandmother-- illiterate. The father and son are now working outside.

Weibei area is in the in transition zone from Guanzhong area to the Shanbei Loess Plateau. It is densely-populated; per capita cultivated land is about 1.5 mu. The source of irrigation water is mainly from the ground water and Yellow River Water Diversion Project. Because of the lack of per capita cultivated land and the low profit of the grain planting, the major income source is from working outside.

The son in the family is growing older and older; the family renovated their house last year. The building area of the house is around 200 square meters. The renovation of the house cost about 100,000 Yuan, which is ten years' family income.

The family has 3 meals a day, actually 2 meals a day strictly speaking. They have breakfast or lunch at around 10 am, and have supper at around 5 pm. Year in and year out, they eat little meat, but live on domestic wheat and maize. On the one hand, it's inconvenient for them to buy meat; on the other hand, people who work outside seldom get the chance to have meals at home. As they live in the national dairy goats' base county, the dairy goat is one of their main economic incomes. Therefore, during the lactation length, all the family can have goat milk, but just occasionally, because the goat milk is one of their main economic incomes. And they have very little egg consumption.

The families don't have routine physical examination. It is an extravagant hope for the family to have

a routine annual check. The government provides a pension of 60 Yuan (about 10 dollars) per month for the aged, which started last year. Therefore, the old-age care mostly depends on the children. The NCMS (new rural corporative medical system) being popularized nationwide in 2010, this family get some tangible benefits. But there is a long distance from their home to even the nearest hospital, so they mainly cure themselves at home unless the diseases get worst. Besides, only after they pay the hospitalization at their own expense can they go to the local government agency to apply for reimbursement. The transportation cost is high, so actually the medical expenses haven't been cut much.

The main source of the family income is from part - time jobs, which is used for educating children and repairing houses. The present situation of Chinese labor force is that supply exceeds demand. So the rural labors become the low-income groups. Besides, the law in the country needs improvement and more efficient governmental supervision. The rights and interests of peasant workers are not guaranteed. There is a lack of social insurance, endowment insurance and business accident insurance for them.

The migrant workers are normally far away from home, which lead to the increase of transportation cost and communication cost. All this will result in the reduction of the migrant workers' income.

The income from agriculture production is used to be self-sufficient in food. They are self-sufficient in food, but the vitamin and vegetables are mainly from purchasing. Generally speaking, the intake of protein is insufficient, especially the animal protein. The per capita consumption of meat is about 5000g. There are 2 reasons for this--the low income of families and the inconvenience of purchase.

The family living in the main grain producing area is engaged in farming, too. There are many elements having an influence on their family production. The first element is the climate. People there are engaged in irrigation agriculture, and the area is in the transition zone of temperate monsoon climate and temperate continental climate. Farmers are at the mercy of the forces of nature. Second, the education for the labor force. The labor quantity is of little importance, and the quality of labor force has a great influence on the agriculture production. The application of chemical fertilizer and pesticide, especially the nitrogen fertilizer is another element. The cost of the application of chemical fertilizer takes up around half of the grain production.

Among them, the use of chemical fertilizer is a large factor.

Fertilizer is to agriculture what grains are to human beings. As one of the most productive countries, China has been adopting the tradition of using fertilizer to increase agricultural production from ancient times. Fertilizer, in China additionally, plays a major role in grain production. Particularly in late dozen years, the extensive use of chemical fertilizer, needless to say, make great contributions to the increasing grain production. As a result, Weibei Plateau witnesses in its produced grains a considerable rise.

In fact, fertilizer is the farmers' biggest material investment of production investment in China.

However, because of the unreasonable factors during the use, the productivity of chemical fertilizer is not effectively developed. The over use of chemical fertilizer causes the decline of soil fertility and the low utilization of fertilizer. And excessive consumption of fertilizers also caused great pollution.

Soil pollution, water pollution and air pollution top the pollution list. Above all, soil pollution can be the first concern.

The cultivation of fruit trees, vegetables, wheat and rice all have the problems of excessive application of fertilizers according to usual application of nitrogen. Wheat, corn, and rice are the principal crops of the Soil-Plant System. According to the First China Pollution Source Census in 2010, the agricultural source of nitrogen accounted for around 57.2%. Excessive application of fertilizer, especially the nitrogen is a main contributor to the pollution.

“In reality, it’s common for farmers to apply 600 kilograms nitrogen per mu. The consumption of nitrogen to vegetables and fruits can be up to over 1000 kilograms.” (Zhang Fusuo)

For winter wheat-summer maize rotation system, excessive application of nitrogen contributes to soil acidification, and the “potential contribution rate” is up to 60%. In the food crop system with vegetables and fruits as its principal crops, the “potential contribution rate” is up to 90%. All this lowers the soil fertility. And in Weibei Plateau, where there is a lack of farmland, this will lead to further soil quality degradation, which will have an impact on our national food security.

Water pollution comes after.

The accumulation of fertilizers and pesticide in drinking water (especially in wells) can have bad effects on all fields of agriculture. Firstly, it causes the eutrophication of lakes and rivers (almost half of the rivers and lakes are in serious eutrophication in China) Secondly, it leads to red tide, which lowers the competition of Weibei Plateau’s agricultural products market. .

Air pollution follows.

The excessive use of nitrogen fertilizer leads to global warming. Nitrogen is one of the major sources of nitrous oxide, which is a much more potent greenhouse gas than carbon dioxide. On one hand, such emission adds to the severe greenhouse effect and damage the ozone layer. On the other, nitrogen fertilizer is fairly sensitive to temperature changes. The generation of nitrous oxide will be accelerated by climate changes, which results in a vicious spiral.

At present, generally, the level of scientific fertilizing is not high enough. Blind fertilizing phenomenon exists in some areas. The waste of fertilizer is quite serious. The cost of agriculture production is increased, but the benefit is reduced. All these lead to the low quality of agriculture and the pollution of environment and speed up the soil quality decline. It directly impacts the sustained growth of grain as well.

In my opinion, according to the developing actuality of Weibei plateau area chemical fertilizer and the dangers of excessive use of fertilizers, it is one of the key measures for the sustainable development of

agriculture for the family as well as Weibei plateau to accelerate the establishment of a scientific fertilization system with the local characteristics and improve the utilization rate of fertilizer resources.

Suggestions are as follows.

Firstly, farmers are guided to use fertilizers economically and efficiently through the price mechanism

“As for farmers, the money of fertilizer for an acre is nothing. It’s not necessary to calculate the cost. There is no motion for farmers to reduce the application amount of fertilizer.” (Zhang Fusuo)

Therefore, raising the price of fertilizer can be a feasible practice. In view of the increased purchase cost, farmers in Weibei Region are to voluntarily reduce fertilizers application.

There are still subsidies for fertilizer industry in China today. It was right when the fertilizer industry was constructed urgently. While facing the excess fertilizer nowadays, it is important to guide the related cities, towns or villages to produce fertilizer rationally, properly and scientifically but not to encourage producing more fertilizer. The key point should be changed from “quantity” to “quality”. There is no doubt that the subsidies worsen the overuse of fertilizer.

Secondly, the supply to the enterprises (fertilizer producers) can be transferred to the farmers (food producers).

Instead of offering fund supply to the enterprises, the government should offer it to farmers. In this way, the farmer can get real money and they won’t purchase excess chemical fertilizers. They will devote it to improving the farming techniques, or other methods that do good to the productivity. By doing this, on the one hand, farmers have no loss. On the other hand, the price of fertilizer reflects its production cost. It is shown as rising prices of fertilizer. In turn, the farmers are guided to reduce too much use of fertilizers.

In this regard, the United States has a similar example.

“Since 2009, the farmers who use slow release fertilizers have been given a subsidy by the United Department of Agriculture. The subsidy standard is 30-55\$ per ha. Every farmer can get no more than 40 thousand dollars a year and no more than 200 thousand dollars within 5 years. This measure has promoted the American farmers’ enthusiasm of purchasing and using slow release fertilizers. And at the same time, it had speeded up the popularization and application of slow release fertilizer in the United States”, says ALVA, the director of the United States Department of Agriculture Research Center. So China can learn from the United States to change its subsidy.

Thirdly, strengthening technical training to improve farmers' planting awareness and knowledge accomplishment

As for the concern among society over abusing fertilizers or pesticides and the misunderstanding that fertilizers and pesticides should not be used in modern agriculture, Chen Yaobang, the former minister of China Ministry of Agriculture, explained the phenomenon. He argued that due to the weak popularization work, people have little knowledge of fertilizers and pesticides in terms of scientific utilization. Thus, agricultural scientists should put more efforts to provide the public with adequate information on fertilizers and pesticides.

Actually, we should not try to keep or increase the yield of crops by increasing the use of fertilizer. Zhang Suofu and his college professor Ju Xiaotang published a paper on PNAS in January 2009, which shows the use of nitrogen fertilizer can be reduced by 30% to 60% to keep the yield.

We should wisely and efficiently use every single gram of fertilizer. In coordination with the dependency among soil, crops and fertilizer, it is an important approach to follow the guiding principle of cooperation between fertilizer and comprehensive agro-techniques and to ensure fertilized varieties, amount, proportion and correspondingly scientific fertilizing techniques.

There is already successful experience on controlling the misuse of fertilizers in the international society. Before 1980s, Holland used too much fertilizer, which caused nitrate pollution, because of the developed aquaculture. The government soon applied rigid measures, such as regulation and fine, to control the use of nitrogen fertilizer. In 1990s, Holland passed the peak of using too much fertilizer. The soil recovered.

Besides, national institutions are powerful departments that regulate national life. In order to change the situation of the use of fertilizer, the perceptions of the government leaders and existing policies should be changed first. The government should lead farmers to use the fertilizer rationally rather than use it more.

Fourthly, countries should increase financial input to the agricultural science and technology infrastructure, training science and technology talents guiding agricultural production.

1. Manufacture

As for manufacture, fertilizer manufacturers should adopt larger-scale, intensive production and promote the quality of fertilizers for sake of advancement of producing technique and modernization of agro-science.

Besides, proceeding from the fact that cultivated crops vary from area to area and growth periods vary from crop to crop, research institution should develop targeted fertilizers based on the practical demands. It's an attempt to either cut the cost or restrain pollution by improving application efficiency.

In addition, it is imperative to attach specific operation instructions to according packaging in order to provide farmers with explicit guidance.

2. Use link

The well trained are essential for agriculture. It's advisable to strengthen the teams of agricultural scientists and technicians. Qualified experts can be dispatched to breadbaskets such as Weibei Plateau and implant scientific farming skills and awareness in local farmers.

In addition, technical help from Farming Technology Bases counts. More bases are supposed to be erected in order to guide local farmers appropriately apply fertilizers. The following aspects can be instructed.

①Organic fertilizer and fertilizer (Nitrogen, phosphorus, potassium, trace elements, and rare earth) should be kept in balance. In use of fertilizer, deep soil, surface soil and leaf surface should be combined together.

②Formula fertilizer application must be based on the performance of cultivated land fertility status, the soil nutrient properties and fertilizer effect, Making the ratio of fertilizers and determining the amount, time and method of application are according to the varieties of crops planted and the demand for nutrients in different growth periods, formulated fertilizer proportion,. First is to know what crops need what kind of nutrients, and how much is needed. It's determined according to the crop varieties and production levels.

②Apply the practice of soil testing and formulated fertilization.

③Reduce the use of chemical fertilizers by using modern technology as a supplementary means. For instance, they can use software "ArcGIS" to calculate the average intensity of using fertilizers in water conservation districts, we can intuitively monitor if too much fertilizer is used in these areas.

④Looking for the substitution for fertilizer

Those are the basic situation, main factors and solutions about the agricultural production in Weibei plateau.

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