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China:, Sustainable Crop Productivity and Food Security

Introduction

1. Increasing Population

Since the late 1950s, the population of China has been increasing rapidly. With the increase incurring in a more positive way then, the tendency hasn't been inhibited soon, which lead to a serious situation. The growth of population was much faster than the productivity of agriculture and on this account the need of grains became more and more urgent. Despite the continuous satisfactory growth of crop yield, enough crop supply of high quality still remains as a major problem in China. According to a latest official report from Chinese statistic agency, 2014 Chinese crop yields has reached 13659.6 tons, which has increased 3.6% more than 2013.¹

While many citizen in rural are (southeastern, northeastern China etc.) are suffering from the lack of food, a large amount of urban dwellers are wasting their rations without treasuring, thus occurring an awkward phenomenon. Because of the increasing pace of urbanization, cultivated fields are being occupied in an unreasonable way. As a result, the area of cultivated fields has reached the 1.8 billion bottom line. In addition, the separate two-child policy opened by Chinese government recently is regarded as an indication of more market demands, which will be a big challenge for crop productivity. At present, China's self-sufficient rate in grain is 90% and average annual grain import has reached 50 million tons, which is higher than the appropriate amount.² All these factors are indicating that it's urgent to improve crop productivity. Considering the formidable obstruction of enlarging the cultivated fields, we should mainly focus our attention on using advanced and beneficial technologies to increase the grain yields, and therefore, relieve the tension in agricultural production. Science and technology is the first productivity after all.

2. Sustainable Crop Productivity

Main method of tillage in China today is still remaining the same as that decades ago. Cultivation is implemented in the unit of households. Each people in a family can get 2-3 acres of field on average. But in total, the area of cultivated field each household has is still in a small amount. And cultivated skills most households acquire are not efficient as expected, thus, many soil resources haven't been

¹ National Bureau of Statistics of China “The National Bureau of statistics about the 2014 summer grain output data bulletin” Jul. 14th, 2014

< http://www.stats.gov.cn/tjsj/zxfb/201407/t20140714_580571.html >

² Baiming Chen, Xiaoping Zhou “中国粮食自给率与耕地资源安全底线的探讨 Analysis on the Grain Self-sufficient Ratio and the Safe Baseline of Cultivated Land in China” doi : [10.3969/j.issn.1000-8462.2005.02.001](https://doi.org/10.3969/j.issn.1000-8462.2005.02.001)

developed utterly. With current cultivation situation, there is plenty of space to develop. The key is a proper ameliorative measure that can increase the crop yields without enlarging cultivated fields, which seems to be impossible in China nowadays.

The reformation led by Chinese government has yet been in a new stage, promoting reform is becoming more and more difficult, many conflicts have engaged. In these conditions, reform in agriculture is undoubtedly going to meet much resistance, but on the other hand, once the reform succeeds, the crop productivity will develop by leaps and bounds. But after all, the reform should base on the development of productivity. Relations of production must conform to the level of productive forces. Thus, the very first task is to lead new techniques into agricultural production

3. Food Security

Enough crop yields are a basic factor of food supply, for the massive needs do urge crop producers to increase their yields. Despite this, the security of the yields is yet another vital factor. Quantity and quality should be taken into account simultaneously. While enough crop yields have been an issue we must confront, current food production is also facing security problems. Mass of crop yields has been tested to have way too much heavy metal. At the same time, water and soil pollution is making the products insecure, and therefore, setting panic among citizens. For instance, soil in Huabei Plain is reported to have excessive element chromium. Toxic substances would accumulate in crops and at last be absorbed by customers. From a long-term point of view, insecure crops will not only have negative influence on production, but on social stability as well.

4. Defining Typical Household

Citing a typical country household in Hebei Province as an example, the members of this family are scattered around in a long distance. The husband is working outside the province and hasn't been home for nearly five years; husband's parents are living in provincial capital with their daughter; the wife is the only member at home and cultivates the field while doing another job in local factory; the eldest son is working in urban area with his marriage approaching and second son is in college. The household's monthly income is about 4000RMB, which mainly comes from the salary from factory. The income is enough to ensure the family's daily routine cost and has a little surplus. But the economic pressure is enhancing day by day. Additionally, this household has plenty of serious issues. Due to the overuse of chemical fertilizers and pesticides, the soil is terribly polluted, which resulted in the low quality of their crop yield and further resulted in the low price of their products. And also, the lack of clean water makes soil even more barren. Since the soil has poor sustainability, their cultivation conditions are getting much worse than ever. Though the agricultural circumstances are with no optimism, the household still didn't pay much attention toward their reality.

This typical household represents thousands of common families settling in northern China. Soil that used to be fertile is now being polluted with no protection. Soil sustainable capacity has become so poor that crop security issue has already engaged. However, it seems that few concerns this issue for few families specially cultivate, because mere cultivation is not enough to support a family. Labor force can't be concentrated on their farm land, which forms the main barrier of improving productivity.

Many families have only the old and children resident at home. Higher salary in urban area from second and third industry has drained mass of labor with robust constitution away. Labor loss has given more pressure to situation which is already serious. On this account, how to improve the yield capacity per individual has and how to increase the sustainability of cultivated soil become even more urgent.

In the ultimate analysis, the problem is from cultivation techniques. Farmers use much more chemical fertilizers and pesticides than the soil recycle system can endure. Toxic substances have abated soil fertility and polluted crops. The detrimental situation requires utter change in cultivation techniques. The negative influence can only be eliminated with high-tech, eco-friendly methods being executed. Based on current productivity level and existing cultivation policies, practical methods should be thoroughly examined before taken into action. Only by fitting both production force and relations can a solution really play an important role in the future production.

Solutions

Considering all the factors mentioned above, the author would like to come up with the following possible solutions:

- I. Highly industrialized production is a practical solution. In America, for instance, family farms are basic units of agriculture. There are about 2.1 million family farms across America. The number has reduced from 6.8 million in 1935 to present quantity. This indicates the tendency of production concentration and oneness in agriculture. Every farm cultivates about 30 acres farmyard and raises 70 oxen in average. According to production patterns, family farms are divided into several kinds of professional farms which separately produce crops, tobacco, cotton, vegetable, fruit etc. The oneness of agricultural production results in high quality of products and high efficiency.³ Detailed methods lie as the following:
 1. Establish family farms across China. Centralizing labor force and merging farmyard are considered as feasible methods. Quest of implementing oneness of production is suggested.
 2. Disseminate spray irrigation and drip irrigation techniques to economize on limited water recourse. This method is based on Chinese geographic situation. Lack of clean water, arid area occupying a large ratio, drought and flood disasters happening with high frequency, all these factors are emphasizing the importance to adopting advanced irrigation technologies.
 3. Bring about a reform of seeding and reaping machinery. All industrialized seeding and reaping would save mass of labor force and therefore reduce the consuming and waste of labor resource. The surplus labor can be put into second and third industry to create more profit to the whole society.
 4. Bring about the prescriptive supply of chemical fertilizers and pesticides. Soil and water pollution is mainly caused by unreasonable use of chemical fertilizers and pesticides. Purchasing these functional substances without scientifically calculating is a common phenomenon in Chinese countryside. So it's really urgent to come up with new methods to manure crops in order to ensure the quantity and security of crop yields.

³ Suonan Jiacao “美国家庭农场简介” doi: [10.3969/j.issn.1005-6718.2006.04.004](https://doi.org/10.3969/j.issn.1005-6718.2006.04.004)

With American cultivation pattern as a positive example, this method is likely to have more feasibility to be popularized by government. But difficulties do exist in some aspects, for industrializing cultivation is bound to result in annexation of land, which is contradictory to Chinese cultivating tradition. Farmers will not likely agree to give their land in order to merge into a much larger one. Though with the government's initiation, family farms, with an increasing tendency, have occurred in many provinces. Further popularization is bound to face more obstruction. Thus, the Chinese government must take a firm hand to propagate the advantages of annexation and formulate new policies to support the reform.

II. Despite the risk of food security, genetic modification would be a practical solution. Many outstanding experts and advanced technologies have been put into relevant researches, though disputes still exist in this field. After all, it can't be denied that genetic modification is promoting production for sure. In 1994, the very first genetically modified product, modified tomato, is on the market. Since then, this technology has been developing in the middle of disapproving opinions and pressure from customers.

This possible solution suggests farmers acquire genetically modified seeds with high quality and cultivate these seeds in order to have a better harvest. The feasibility is affected by plenty of factors:

1. To the great extent, modification process affects the quality and security of modified seeds. Thus, Chinese government ought to provide mass of funds input to increase the technology level. Modification should integrate local situation and base on the orientation of anti-drought, anti-vermin, requiring less fertilizers and having plump fruits so that more yields can be provided with limited land resources. But on the other hand, all the risking factors must be prevented in modification process. This requires the reinforcement of controlling and inspecting. Insecure breeds should be banned immediately. Only those with permission from quarantine agencies can be allowed to sow.
2. Once the high quality breeds have been developed, it is government's duty to popularize these beneficial seeds. In the first year, the breeds are supposed to be popularized without compensation. Leading by government, seeds ought to be sowed and cultivated in typical farmland that can represent local farming conditions. After the harvest, crop yields must be examined in details and following actions must accord to the result. Additionally, government should also give subsidy toward relevant products, in order to ensure the popularization be pushed forward smoothly.
3. When modified breeds are on the market, government should also subsidize relevant products, and coordinate with propagating, to ensure that customers gradually accept these products. Special logos ought to be designed to mark modified products.

The main obstruction of this solution is public opinion's exclusion toward modified produce. Thus, government should take effective measures to dispel misgivings. And on the other hand, government must guarantee the security of modified breeds. Genetic modification is a technology with great potentiality; current crop pressure would be relieved if this solution is popularized properly.

III. Stereoscopic agriculture, defined by Dr. J. R. Smith in early twentieth century, is a new type of comprehensive agriculture that combines planting, animal husbandry and sideline production.

Stereoscopic agriculture utilizes mutual relationship between different creatures, enlarges advantages and avoids disadvantages.⁴ New cultivation in stereoscopic agriculture should base on soil less culture and brand new planting technologies. The purpose is to bring about comprehensive stereoscopic farms so that intensive and specialized agriculture would come true. Possible methods lie in the following:

1. Guided by government, developed provinces should launch pilot projects at selected points. Farmers ought to explore for establishing stereoscopic farms based on own circumstances. Blending of crops with different height, for example, is a practical method to make full use of sunlight resource.
2. Popularize soil less culture technologies; bring about wide adoption in domestic agricultural production.

This solution has the least risk, and fairly mature experiences have already been applied in southern and northeastern China. In Liaoning Province, by adopting four stereoscopic agricultural methods for three years, crop yields have increased 1.88 million tons and agriculture production is highly thrived by the development.⁵

By adopting solutions mentioned above, the chosen typical household's production would be greatly improved. The husband and two sons would have more spare time to work outside their village. The wife herself is enough to cultivate the land and have fine harvests. Crop yields with high quality and quantity would ensure the household to have enough income to improve living conditions. Or to the best scenario, several family farms or crop factories with high efficiency would be set up in the village. Family members will be able to work in the farm as specialized workers. Family living conditions would also be improved. In a long-term perspective, adopting these methods would result in increase of crop yields and food security. More crops would be floated into the market and thus a more scientific crop market would come to reality.

All three solutions mentioned above are with great feasibility and can have positive influence toward Chinese cultivation situation. Both crop yields and food security will be solved by adopting these solutions. However, these are only draft methods. Plans that can really take into action would need more details and be deeply discussed by relevant experts.

According to a global survey, the United States of America has lost billions of dollars because of three serious flood disasters which separately happened in 1993, 2007 and 2008. And also, the surface soil was grievously eroded. Focus on South Asia, the change of precipitation pattern and temperature level would possibly reduce 30% of India's crop yields by the end of this century. More seriously, per capita available cultivating land has lessened from one acre to half acre since 1970. Additionally, previous irrigation techniques have used 70% of clean water on this planet. Surplus water that can formerly been recycled was polluted by dust, fertilizers and pesticides. All these issues have caused terrible consequences. These negative effects have made adopting sustainable agriculture methods even more urgent.

⁴ The New York Times "Stereoscopic Agriculture----Perfect Solution for Global Famine"

⁵ Chunfeng Yan, Yu Wu, Yingwei An "辽宁立体农业生产模式研究" File code: 1003-4803(2002)04-0229-04

Governmental responsibilities

The government of China takes a major role in solving poor agricultural practices. The reformation is the main avenue held by government. A highly complete agriculture system requires national policies, scientific researches and accepting from farmers. Among all, one factor that cannot be ignored is proper policies. Production relations must fit production force, and relevant policy is one major factor that decides production relations to a great extent. Thus, government ought to form a specialized expert squad to study both positive and negative influence caused by new solutions and then formulate legislations or policies that are related to solutions. Another critical factor is market. When choosing different methods, whether the crop yields would be welcomed by customers should be taken into account. Solutions can only make profits and have positive effects when products possess the market.

However, the advanced technologies and policies being popularized seem to confronting barriers. The resistance is mainly from farmers, especially those from rural areas. Conservative culture makes these people hard to accept advanced strategies. Thus, education is the most important factor worth to be concerned in order to overcome the resistance. Only by educating farmers can they accept reformation so that a more sustainable cultivation pattern would be popularized all over China.

Obligations of Citizens

Citizens, especially those who engage in agricultural production, play very critical roles in agriculture. In order to better domestic cultivation, their obligations should be made clear as coordinating with government, accepting reformation with new policies and adopting advanced technologies popularized by government. Receiving education with self-consciousness is also strongly suggested. Furthermore, citizens should hold enthusiasm toward innovation of cultivation technologies and try to create and develop new cultivating methods with high efficiency.

Organization (CAGS)

CAGS stands for China National Association of Grain Sector. This organization serves as a vinculum between government and corporations. This organization helps national bureau to manage agriculture production, trains new well-known brands, provides professional consultation and education, develops farmers' quality and mediates disputes.⁶ CAGS has achieved great success and yet need more development. Government ought to pay more attention to these non-governmental organizations and make full use of them. Positive policies should be formulated in order to give these organizations more authorities so that their effects can be highly enlarged.

Conclusion

Crop production and food security are both vital issues for China. The improper cultivation pattern and unreasonable agricultural policies are strongly suggested to be replaced by high-tech, eco-friendly methods mentioned in this paper.

⁶ CAGS (China National Association of Grain Sector)
< <http://www.chinagrains.org.cn/new/intro/intro.asp> >

Practical solutions can only play roles in agriculture with guarantee of relevant policies and legislations. Projects are supposed to be guided by government and require the participation of every agricultural individual.

Obligations should be fulfilled by both government and citizens. Only with cooperation can reformation be taken into action more smoothly and successfully.

The current agricultural production situation is at emergency and should be highlighted by government. Valid solutions must be adopted to improve the cultivation circumstances. New reform is sure to be taken into action.

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