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# The Leading Role of Governments in Promoting Chinese Agricultural Clean Production

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**Abstract** On the basis of summarizing agricultural clean production, the theoretical basis of the leading role displayed by the government in promoting agricultural clean production is expounded. The characteristics of agricultural products, such as the hidden environment quality of agricultural production, spillover of profits and the benefits, make governments to display the leading role in promoting agricultural clean production at the primary stage in particular. The restrictive factors in promoting Chinese agricultural clean production are put forward, which include idea restriction, technology restriction, talent restriction, economic restriction and policy restriction. Countermeasures which should be adopted by governments on promoting Chinese agricultural clean production are put forward. Firstly, the laws and regulations for promoting agricultural clean production should be established and perfected gradually; secondly, the evaluation system for agricultural clean production should be established; thirdly, the promotion on agricultural clean production should be intensified; fourthly, the practical technologies and applications of agricultural clean production should be guided; fifthly, the industrialized operation of ecological agriculture should be vigorously promoted.

**Key words** Leading role of governments, Agricultural clean production, Restriction factors, Sustainable development, China

At present, the extensive agricultural production way with high energy consumption, high pollution and low quality has seriously impeded the healthy development of Chinese agriculture. Exploring a developmental way, which can both ensure the sustainable development of agriculture and realize the harmonious development of agricultural production, human health, and natural resources, has become an imperative choice. Agricultural clean production stands for the reduction and even elimination of pollution to a large degree from the fountainhead; the control over the whole life cycle of products and the full consideration on environment in the whole life cycle of design, production, use and even waste of the products. Therefore, implementing agricultural clean production is the demand of improving the quality of Chinese agricultural products and realizing agricultural sustainable development, as well as the demand of enhancing Chinese food safety and life quality. Based on the recognition of agricultural clean production, the paper has proved the leading role displayed by governments in promoting agricultural clean production; analyzed the restriction factors on promoting Chinese agricultural clean production and pointed out the measures that should be adopted by governments in promoting Chinese agricultural clean production.

## 1 Summary of agricultural clean production

**1.1 Clean production** The concept of clean production is put forward by United Nations Environment Programme (UNEP) in 1989. The definition is as follows. Clean production continuously applies the environment strategy of comprehensive prediction and control into production process and products to reduce its

risks to human and the environment. With production process, clean production includes raw materials and energies, weeding out poisonous raw materials and diluting the quantity and poison of the poisonous raw materials before leaving production process. With products, the clean production strategy aims at reducing the impacts of the products on human and environment in their whole life cycle. Clean production does not include terminal treatment technology, such as air pollution control, waste water treatment, incineration and landfill of solid wastes. The treatments on them are realized by applying specialized technology, improving techniques and changing management attitudes<sup>[1]</sup>.

The content of clean production can be concluded as "three clean and one control", that is, clean raw materials and energies, clean production process, clean products and the control throughout clean production. In the first place, clean raw materials and energies. Clean raw materials and energies are those, which can be fully used and seldom reduce wastes and pollutions in the process of producing products. Selecting raw materials is an important prerequisite of clean production. In the second place, clean production process. Clean production process is to select certain technologies in production process to reduce the quantity of wastes, change wastes into resources and eliminate the harm of wastes, and then to wipe out wastes in the end. In the third place, clean products. Clean products are the products, which do not exert harmful influences on the of effective use of resources, reproduction, use and treatment of them. In the forth place, clean production also demands two "whole process" control. The first one is the control of the life cycle of products. The second one is the control on the production process. The basic aim of clean production is to improve the use efficiency of resources, reduce and avoid the production of pollutions; protect and improve environment; ensure human healthy and promote the sustainable de-

velopment of economy and society.

**1.2 Agricultural clean production** At present, the necessity of clean production in industrial fields has been widely accepted and clean production has been applied into practice gradually, but people's recognition on clean production in agricultural fields has been in a primary state. However, in the process of modern agricultural production, the massive and irrational use of chemical products has seriously damaged agricultural ecological environment, polluted agricultural by-products and threatened human health and the whole human living environment. Agricultural fields also need clean products as that in the industrial fields. The advocators of "organic agriculture", "natural agriculture" and "ecological agriculture" propose to reduce or even do not use chemical fertilizer, pesticides and some other agricultural chemical products. The practices both at home and abroad have proved that at the present stage, the wide popularity of the agricultural development model, which completely abandons of the use of chemical fertilizer and pesticides, is impossible. In view of the current technology, the development of agriculture can not separate from chemical fertilizer and pesticides, especially, in China, whose agricultural production level is relatively backward. So, we should seek for a sustainable development way for agricultural production, which does not exclude chemical fertilizer and pesticides. But when using the chemical products, their ecological safety should be taken into consideration to reach the integration of economic, social and ecological benefits. This kind of agricultural production model is agricultural clean production.

Agricultural clean production is to continuously apply the environment strategy of overall prevention of industrial clean production to agricultural production process, design of products and services of products to increase ecological efficiency. It requires the production and use of green agricultural tools (green fertilizers, green pesticides and green land film), which are benign to environment; the advancement of agricultural production technology and the reduction of the quantity and poison agricultural pollution to reduce the risks on environment and human in the process of agricultural production and services. Clean production is of great significance, in the first place, it is beneficial to rationally using and protecting natural resources and reducing the consumption on agricultural resources; in the second place, in the process of agricultural production, clean production can effectively reduce the production and emission of pollutants. The most important thing is that, clean production can prevent agricultural products from being polluted by poisonous materials; improve the quality of agricultural products; promote the tolerance between production and consumption of agricultural products and environment; and abate the risks of agricultural activities to human and the environment.

## 2 Theoretical evidence of the leading role displayed by governments in promoting agricultural clean production

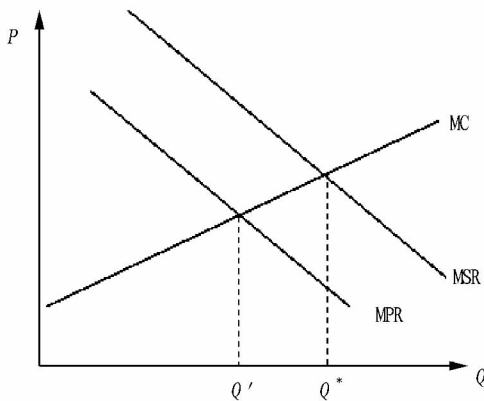
**2.1 Invisibility of the environment quality of agricultural products** The quality of agricultural products is an important

source for constructing the competitive edge of agricultural products. The quality of agricultural products has attracted more and more attentions. The characteristic of environment quality is an important component of the characteristic of product quality. However, the quality of environment is characterized by its invisibility, the buyers, especially common consumers can not fully understand the characteristics of environment of agricultural products. According to consumers' understanding on information, ZHANG Yu classifies the quality of agricultural products into three types. The first one is observation type. The outward appearance, freshness degree of agricultural products is of this type. Before purchasing agricultural products, consumers can evaluate them by using their common sense, tag and grades of agricultural products, so as to judge the quality of agricultural products. With some fresh food, the consumers can evaluate their quality by observing, smelling and feeling them. The second one is the experience type. Consumers can not obtain the real information of the quality of agricultural products before buying them, they can master the quality of them, only by consumed them. Sometimes, through multiple times of experiences, the quality of the agricultural products can be evaluated, for example, the glutinous features of rice can only be judged by eating it. The third type is the trust type. Some quality information contented in agricultural products can not be determined and judged even after the products being consumed. For example, whether the agricultural products adopt clean energy and raw materials or not; whether the production process is in accordance with environmental protection demand; whether the products has illegal additives; whether the products are genetically modified products, so the decisions made by consumers are based on the mutual trust<sup>[2]</sup>. Consumers' trust on these kinds of products may be based on the quality guarantee of sellers or the quality certification of the third party.

The environment quality of agricultural products belongs to trust features and it is hard for consumers to judge the quality of them by using their experiences or through observing. The essence of the invisibility of environment quality of agricultural products is the asymmetric information between producers and purchasers. Thus, the environment quality of agricultural products can not be detected by consumers, at the same time; the advantaged features of environment quality obtained by clean production can not be fully displayed. Under the system of market-oriented economy, the solution for solving asymmetric information is the government interference. The government issues clean production marks to give access to full information for the masses, and then help them to make right choice.

**2.2 Spillover of the profits of agricultural clean production** Spillover is the positive or negative impact caused by the economic behavior of a certain economic main body on other economic main bodies but did not get any profits or did not pay any costs under the situation of market economy. From the connotation of spillover, we can see that, the spillover can be divided into two situations; the first one is positive spillover. It means bringing positive impacts on others but has not obtained

the relevant rewards. For example, planting trees may provide timber, but it can also play the role in regulating climate, keeping water and soil, cleaning air and beautifying environment. The man who plants the trees can get the market price of timber and its products, but the market prices of spillover interests, such as moderating climate, beautifying environment *et al.*, can not be obtained. The second one is the negative spillover. Negative spillover brings bad effects on other people, but does not pay the due prices. That is to say, adding its costs to other economic main bodies. For example, the paper-making mill may cause environmental pollution. At the same time of getting the products, the paper-making mill may emit "waste water, waste gas and solid wastes", but the paper-making mill only pays for the direct production costs of the products, rather than the social costs of the wastes it emits. Both the positive spillover and negative spillover will cause the failure of market, which may lead to the inconsistency of actual yield and optimized yield<sup>[3]</sup>. Through promoting clean production, for one thing, agricultural producers can get agricultural products; for another thing, it can protect environment, save resources and ensure human health. For the agricultural producers, these spillover interests can not be compensated.



**Fig. 1 The analysis on the optimized quantity of positive spillover**

When the economic activities bring positive spillover, the economic main bodies can not get compensation from the spillover interests, so when determining the level of the economic activities, those interests are not taken into consideration. Economic main bodies only select the level of activities from the perspectives that marginal private returns are equal to the marginal private costs. It can be seen from Fig. 1 that the axis is the quantity of products; the vertical is the price of products; and MC line is the marginal cost curve (the costs do not have spillover interests, so the MC is both the marginal private cost curve and the marginal social cost curve). With the growth of the quantity, the marginal costs of the products raise gradually. MPB is the curve of marginal private benefits and MSB is the curve of marginal social benefits. As for producers, if they want to obtain great profits, they should let  $MC = MPR$ , so the actual quantity of products is  $Q'$ , but as for the society, only when  $MC = MSR$ , the maximum benefits  $Q^*$  can be realized. Obviously,  $Q'$  is smaller than  $Q^*$ .

In the primary stage of promoting clean production, the social effects were very obvious, but the direct benefits bought to agricultural producers were limited. Thus, the marginal private interests were smaller than the marginal social benefits, which would definitely lead to the low enthusiasm of agricultural producers on promoting agricultural clean production. Under such situation, the government should participate in to adopt measures to compensate the positive spillover. The government can apply the legal, administrative, as well as economic measures.

**2.3 Clean production is the merit goods of agricultural products** Merit goods is the products that are beneficial to social members, but due to the ignorance of social members, the consumption of these kinds of products is insufficient<sup>[4]</sup>, for example education, green food and such. The opposite ones are demerit goods, which will bring harmful impacts on social member, but due to the ignorance of social members, the consumption of them is excessive, for example cigarettes, wine and such. When the insufficient or excessive consumption of the merit goods and demerit goods appears, the government should display its role as the parent and adopts the patriarch management. It should influence the consumption preferences of social members by the legal, administrative or economic ways, so as to increase their consumption of merit goods and decrease their consumption of demerit goods, and then, to improve the well-being of them<sup>[5]</sup>.

Agricultural products produced by clean production are definitely the merit goods. Agricultural products produced by clean production are in accordance with the clean standards. The production applies clean raw materials and energies, clean production process and clean products. Clean production is environmental friendly; what's more, it is conducive to the health of social members. Therefore, social members should increase their consumption of merit goods. If we take the model of agricultural clean production as a substance, as for the agricultural producers, the substance is a kind of merit goods. Although in the primary stage of promoting agricultural clean production will cost more, the productive model would bring great economic benefits for agricultural producers ultimately and would realize the sustainable development of agriculture. When the consumption of agricultural products produced by clean production and the model of agricultural clean production is insufficient, the government should vigorously apply various approaches to interfere in the consumption preferences of social members and positively facilitate the model of agricultural clean production by the way of stipulating laws and regulations, providing fiscal subsidies and intensifying popularization of clean production.

The conclusions can be drawn from the above analysis that due to the invisibility of agricultural environment quality and asymmetric information between consumers and producers, the advantages of clean agricultural products can not be displayed. The spillover effects of agricultural clean production press agricultural producers' enthusiasm on promoting agricultural clean production. The merits of agricultural clean production need the interference of the government. The government should influence the consumption preferences of social members and guild

social members to consume clean agricultural products and lead agricultural producers to promote the model of agricultural clean production. Therefore, the government should display a leading role in promoting agricultural clean production, in the primary stage in particular.

### 3 Restrictions confronted by promoting agricultural clean production in China

Under the current situation, some disadvantaged factors, including idea, technology, talents, economy, policies *et al.*, still restrict the popularization of agricultural clean production. It is necessary for Chinese government to adopt some measures to break through these restrictive factors, so as to popularize agricultural clean production.

**3.1 Restrictions of idea** Idea has impeded the promotion of Chinese agricultural clean production to a large degree. So far, the leaders from the environmental protection departments, economic comprehensive departments, agricultural departments, and farmers have not reached a consensus on the great significance of clean production in environmental protection, energy saving, and improving economic interests. Hence, they can not feel the urgency and pressure of promoting agricultural clean production and the areas, which want to implement agricultural clean production can not get relevant support and subsidies. The farmer is the real engine for implementing clean production, but farmers do not fully understand clean production and the support of technology and capital is absent, so the promotion of clean production has been restricted. Leaders from various departments have not clarified the positive thinking on pollution prevention throughout the process of agricultural production and have not taken clean production as an important measure to improve the overall quality of agriculture and enhance the competitiveness of agricultural products. Clean production has long term effects, but the relevant departments only care about short term effects and do not want to invest capital in it.

**3.2 Restrictions of technology** From the perspective of new technology development, the current environment technologies focus on terminal handle technology, which leads to the serious insufficient technologies of agricultural clean production. As yet, no system for promoting and applying agricultural clean production has been established. The source of new technology exploration is the demand of new technology. However, there is no massive market demands to push the formation and development of agricultural clean production technologies (from exploration, maturity to application).

**3.3 Restrictions of talents** Knowledge required by agricultural clean production is not only the technology, but also the subject concern economics, sociology, ecology, law and environmental protection. Due to the lack of the talents with comprehensive knowledge, agricultural clean production can not be further implemented and taken into effects rapidly.

**3.4 Restrictions of economy** From the long term perspectives, implementing agricultural clean production can cut costs, improve the use efficiency of raw materials and reduce pollutions. But in the primary stage of economic input, due to the

lack of the way to evaluate the comprehensive interests (economy, society and environment), that is to say, the lack of intermediary measurement, and the difficulties in correctly analyzing and accounting the multiple changing influences, most departments can not see the actual interests and high potential benefits implementing agricultural clean production. Besides, agriculture is characterized by its weakness, so it is hard to implement the feasible pollution prevention technology cases.

#### 3.5 Restrictions of policy

**3.5.1 Financial policy.** In advance countries, the agricultural clean production is promoted through the combination of government subsidy and policy guidance. But at present, the capital of Chinese agricultural clean production is hard to be guaranteed. There are more legal stipulations, policy-based encouragement and the other documents, but less stimuli policies and capital compensation system for agricultural clean production. At present, the government can only provide limited capital and the relevant stimuli policies and capital compensation mechanisms of agricultural clean production are absent. The guaranteed capitals of agricultural clean production do not have smooth channels and the preferential policies provided by the government are not so obvious, so farmers are unwilling to implement agricultural clean production. Agricultural clean production has not only environment benefits, social benefits, but also better economic benefits. But agricultural clean production needs the capital input, which can not be solved by farmers themselves. What's worse, due to the low capital interests of Chinese agricultural department and high risks of implementing agricultural clean production, the commercial department does not willing to provide loan.

**3.5.2 Environment policy.** At present, laws and regulations on agricultural environment in China are imperfect and the environmental pollutions caused by traditional agricultural model can not be restricted effectively by legal or administrative approaches, so a large majority of farmers would rather insist tenaciously the old production model, rather try new production model. Thus, the engine for promoting agricultural clean production is absent, which leads to serious wastes.

### 4 Measures that should be adopted by Chinese government in promoting Chinese agricultural clean production

**4.1 Gradually perfecting legal and policy system in promoting agricultural clean production** In recent years, Some progresses have been made in China in terms of legislation of agricultural clean production, which has laid a solid foundation for the further improvement of clean production. However, these laws and regulations are scattered dispersedly in *Agricultural Law, Agricultural Environmental Protection Law, Law of Promoting Clean Production, Law of Preventing and Controlling Water Pollution, Law of Preventing and Controlling Air Pollution, Registration and Administration of Fertilizer, Management Measures for the Production of Pesticides*. Due to the lack of special laws and regulations on agricultural clean production, the idea of agricultural clean production has not been

fully represented. Through loose legal provisions and regulations, it is hard to implement clean production into agricultural production. The fail implementation of Chinese agricultural clean production is largely due to the lack of legal system. Therefore, it is necessary to legislate agricultural clean production, make up for the relevant space, intensify the forces of law and perfect legal contents and make laws and regulations for agricultural clean production.

Except for the relevant legal protection, the smooth implementation of agricultural clean production also needs the relevant national policies. For one thing, it should reflect the restrictive forces of law, for another thing, it should improve farmers' enthusiasm. For example, the government should promote the construction of new type farmers' cooperative organization, scientifically distribute the planting area of various kinds of agricultural products and subsidize farmers properly. Besides, the government should intensify the policy support in agricultural research; fully support them in terms of credit and provide necessary capital foundation for clean production.

**4.2 Establishing the evaluation system of agricultural clean production** At present, China has established the index system of clean production in 54 industries and the scope is expanding gradually. However, in agricultural field, the index evaluation system of clean production has not been established. The following principles should be followed when selecting index evaluation system of clean production: firstly, considering the whole life cycle of production; secondly, reflecting the idea in preventing pollution; thirdly, easy to be quantified; fourthly, the statistics are easy to be obtained. The specific selection should be conducted according to the following demands. Several indexes are selected to evaluate whether the section of products is in accordance with "clean raw materials and energy", "clean production process" and "two whole process controls".

**4.3 Strengthening the agricultural promotion of clean production to farmers** The authority should popularize the environmental protection knowledge, ecological knowledge and knowledge of sustainable agricultural development to farmers to make them aware of the importance of environmental protection and the dangers of environmental pollution, agriculture through advocacy. Through popularizing agricultural clean production, the grassroots farmers can clearly recognize the agricultural environmental benefits and economic benefits of agricultural clean production. In addition, the active promotion of scientific farming methods, reducing input costs and increase economic benefits in the process of clean production can improve farmers' production enthusiasm. Finally, the establishment and promotion of the quality and brand of agricultural products should also be focused on to get higher value. By this way, farmers' enthusiasm on implementing agricultural clean production can be promoted essentially.

**4.4 Promotion and application of practical technologies of agricultural clean production** Agricultural pollution mainly dues to the chemical fertilizers, pesticides, plastic sheeting and other irrational use of agricultural means of production. There-

fore, the promotion of agricultural practical technology is an important technological way for promoting agricultural clean production and preventing agricultural pollution. In the first place, the fertilizers should be properly used to achieve scientific use and the formula fertilization should be promoted. The microbial fertilizer should be developed and used to reduce the amount of fertilizer required. In the second place, the clean and nuisance free technology fertilizer should be applied to reduce the amount of fertilizers used. In terms of pesticide production, it should pay attention to the application of high-efficient, low poisonous and low residual and the use of pesticides with high toxicity should be abandoned. In terms of using fertilizer, the scientific, rational and safe use of fertilizers should be applied. The nuisance free pesticides should be used to implement biological control. In the third place, the environment-friendly and degradable agricultural film should be used. In the forth place, the urban waste water and heavy metals in industrial waste water, which is used as irrigation should be stipulated, as well as the standard of poisonous organics and the pH value.

**4.5 Actively promote the industrial management of ecological agriculture** The development model of ecological agriculture not only offers the technology way for reference for clean production, but also promotes the implementation of agricultural clean production to a certain extent. The so-called ecological agricultural industrialization refers to the development process of ecological agriculture as a separate industry sector with a view of market economy, through effective industrial organization and operation of the industrial mode of operation, according to a market economy within the requirements in order to improve the ecological agricultural economic efficiency. From the horizontal perspective, it implements the intensification capital, technology, land, labor and other factors of production. From the vertical perspective, it is market-oriented; takes processing process and cooperative economic organization as the basis; based on the majority of farmers; takes. It integrates the sections of before production, production and after production into a whole industrial system; realizes the integrated operation of planting, breeding, selling, agriculture, industry and commerce; transfers the dispersed small scale production into large scale production; combines the non-market arrangement within the system and market mechanism to realize resource allocation; promote the growth of ecological agriculture and realize the self-accumulation, self-adjustment and independent development of ecological agriculture<sup>[6]</sup>. Industrial operation of ecological agriculture is an effective way for increasing farmers' income, as well as an effective approach for promoting Chinese agricultural clean production and realizing healthy and stable development of agriculture in the atmosphere of market-oriented economy.

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communication, culture, education and entertainment, and medical care, tend to decline. The marginal propensity to consume of housing tends to rise. In the current consumption structure of rural residents in Gansu Province, food expenditure

is still at the most important and most basic level, indicating that the overall level of consumption of rural residents in Gansu Province, is still not high, and at low-level existence-oriented consumption stage.

**Table 4 Price elasticity of rural residents' various consumer goods compensated by income in Gansu Province in 2008**

Item	Food	Clothing	Housing	Household appliance	Transportation and communication	Culture, education and entertainment	Medical care	Others
Food	-0.192	-0.217	-0.278	-0.365	-0.252	-0.313	-0.352	-0.341
Clothing	-0.008	-0.198	-0.031	-0.041	-0.028	-0.035	-0.039	-0.038
Housing	-0.019	-0.062	-0.328	-0.105	-0.071	-0.089	-0.101	-0.098
Household appliance	-0.004	-0.014	-0.018	-0.311	-0.017	-0.021	-0.023	-0.023
Transportation and communication	-0.013	-0.040	-0.238	-0.067	-0.256	-0.057	-0.064	-0.063
Culture, education and entertainment	-0.011	-0.037	-0.047	-0.063	-0.043	-0.316	-0.060	-0.059
Medical care	-0.007	-0.023	-0.028	-0.038	-0.026	-0.032	-0.320	-0.036
Others	-0.002	-0.005	-0.006	-0.009	-0.006	-0.007	-0.008	-0.269

Second, the income elasticity of demand of eight categories of goods and services, is positive, indicating that with improvement of income level of rural residents in Gansu Province, farmers' consumer demand for various types of consumer goods will continue to increase. Thus, improving farmers' income level, is the key to expanding the rural market and improving purchasing power in rural areas. However, farmers' income has different impacts on increase of farmers' income and consumption of farmers. Therefore, the improvement of farmers' income will lead to the continuous adjustment of the consumption structure in rural areas.

Third, the consumer demand of rural residents' housing, household appliance, culture, education and entertainment, medical care and other aspects in Gansu Province, is most vulnerable to variation of their own price; the consumer demand for food, clothing and transportation and communication seldom fluctuates drastically due to the variation of their own price. Thus, by adjusting the price concerning housing, household appliance, culture, education and entertainment, medical care and enjoyment-oriented, development-oriented data, the effect of adjusting the corresponding consumer demand in rural areas is ideal; by adjusting the price of food, clothing, transportation and communication and other basic living expenses, the effect of adjusting the corresponding consumer demand in rural areas is poor.

Fourth, the impact of food price change on demand change of other types of consumer goods is significant, but the impact of price change of other commodities on consumer demand change of food in rural areas, is relatively weak. Thus, food price change spreads wide, with deep impact; adjustment of food price has evident effect to the regulation of the rural market. In this regard, we should require full attention and adopt prudent measures.

Fifth, improving the level of disposable income of rural residents in Gansu Province or providing cash subsidy and preferential price for daily consumption of residents, will not only help

increase the actual demand of rural residents' various consumer goods, but also alleviate "crowding-out effect" of consumption of food, housing and other means of subsistence on consumer spending on other aspects, and play a positive role in driving consumption of rural residents and promoting overall level of consumption.

Sixth, currently, the rural residents' consumption in Gansu Province is still determined by income, and residents' low-level disposable income, slow income growth and low marginal propensity to consume in Gansu Province, is the root cause of lack of residents' consumer demand. So in order to expand rural consumer market in Gansu Province to promote economic growth, we must study how to improve the income of rural residents.

Seventh, imperfect and unsound rural social security system, medical insurance system, the rural public goods supply system, is important factor responsible for rural residents' emphasis of living consumption on existence-oriented consumption. Compared with urban residents, the rural residents have low income, and have to assume heavy burden in pension, health care, education and other aspects. Therefore, gradually solving rural education, health care, social security and other issues is a necessary condition for increasing farmers' income, and vitalizing rural purchasing power.

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