Predict the grain output of Xinjiang Province based on the time series model

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Abstract: In this paper, the variation trend for the grain output of Xinjiang Province has been analyzed and forecasted based on the time series model and tendency forecast model. The mathematical models are established by using both the historical data from 1949 to 2011 and the weight analysis of each part is given attention, so the predicted results are more reasonable. Furthermore, the problems of the grain production in Xinjiang Province are pointed out. Finally, the suggestions and conclusions are given in view of the problems.

Key words: Time series model; fitting; Trend prediction; Logistic model
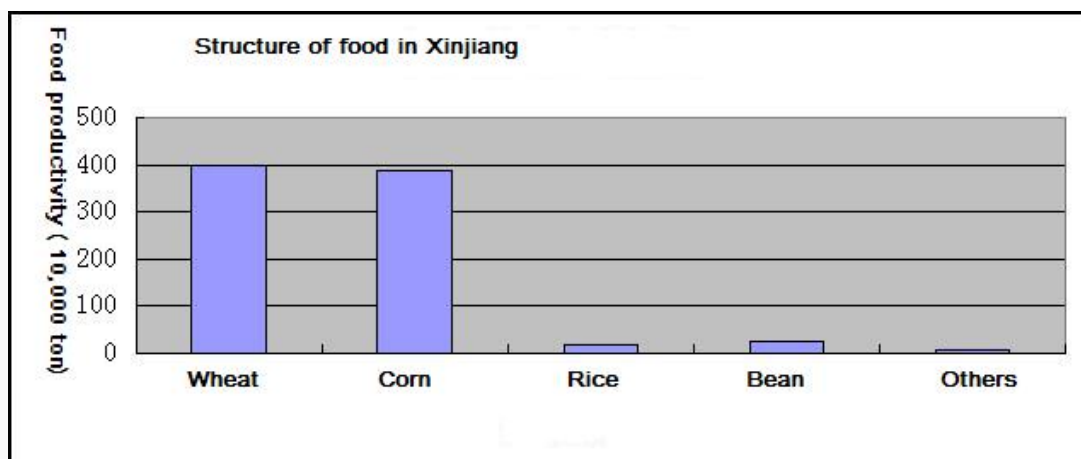
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1. Introduction

The grain is very important strategic materials and account for a large proportion of Xinjiang economy. With the implementation of the western development strategy, the strategic adjustment of the agricultural structure of Xinjiang is also meeting with the historical opportunity. Reasonable utilization of land and reasonable planting structure play a very important role for the food industry development. So, on the change of grain output analysis and accurate prediction is very urgent. In Xinjiang grain production history, It has been one of provide for oneself, a slight surplus. In 1999, it is a high point for the commissariat production, the grain output amount to 8380000 tons, however, because the market price and other factors, since 2000, Xinjiang grain production glides all the way. For the implementation of national food safety strategy and ensuring commissariat produces safety, Municipal Party committee and the government adopted a series of preferential policies supporting agriculture, promulgated commissariat fills continuously, the thoroughbred allowance, the agriculture machinery allowance, reduce and cancel the agricultural tax, price

protection and the personnel of agricultural science and technology to promote the wheat high-yield model policy, and called on all the localities to grasp grain production as a political task.

In the face of new change of grain security situation in Xinjiang, Face up to the grain security problem and get a clear understanding of the grain supply and the demand situation. It has an important significance for implementing the central spirit and requirements and ensuring the economic society development stable and healthy. For solving the problem of grain in the province, scientific and accurate analysis and forecast the future trend of grain production, focus on promoting grain output, Then that is an important decision to all the levels of the government decision-making department food distribution and macro economic, even to safeguard grain security has a very important significance.
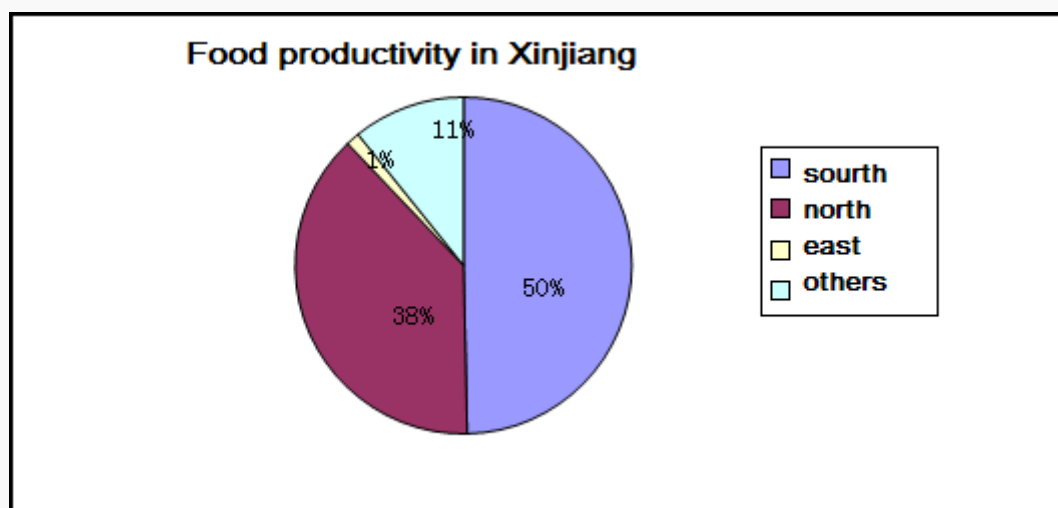
2. Relevant materials and forecasting method of grain industry

2.1.1 The present situation of the grain structure

The proportion of wheat and maize is above 87%. Wheat and maize in Xinjiang is the main food crops, rice and other crops are smaller proportion.
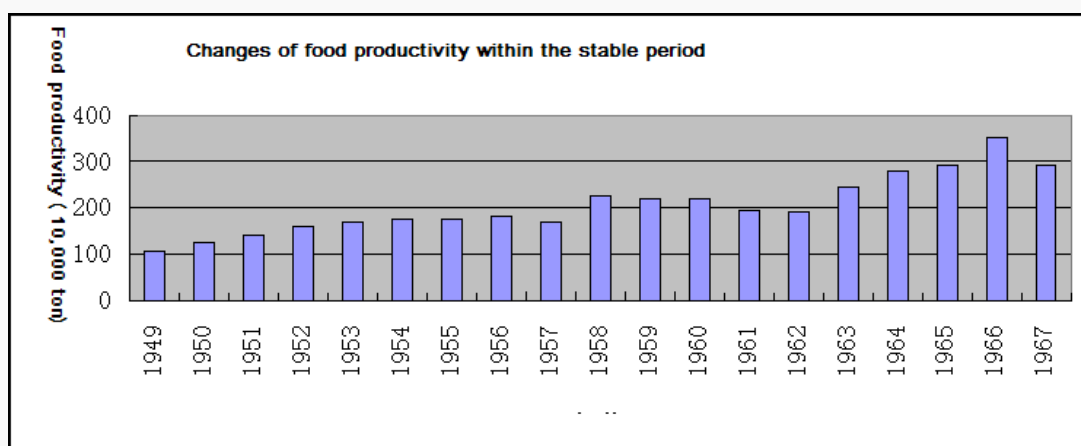
2.1.2 Regional structure status

The grain proportion of Southern and northern Xinjiang is about 88%, It is visible regional difference in Xinjiang grain.
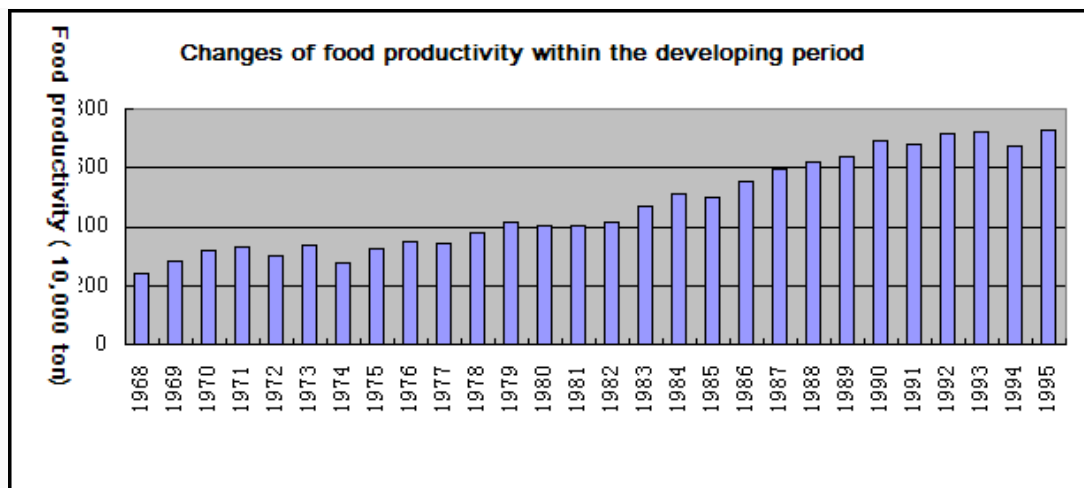
2.2.1 The changing process of grain industry

The food production in Xinjiang trend is divided into three periods:
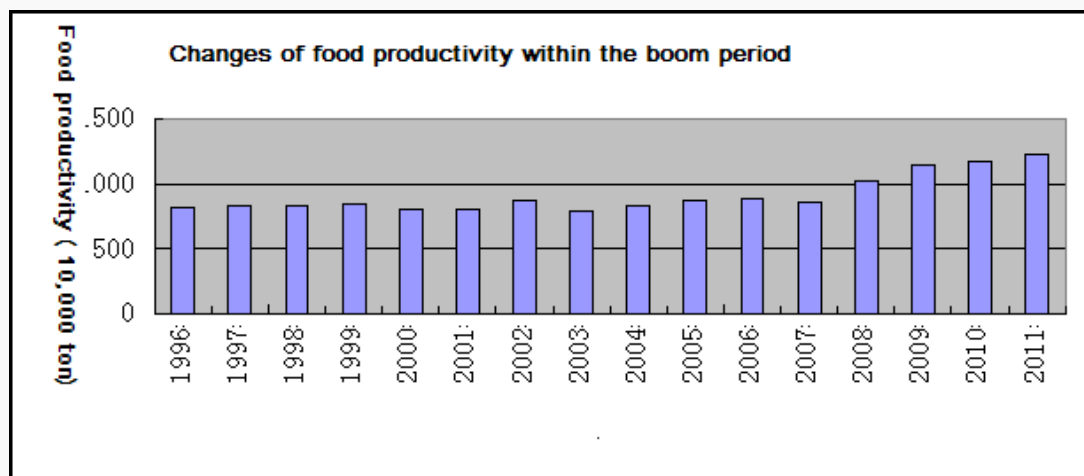
Stationary period: 1949-1967. Grain output steady growth, in 1947 reach the top. The stage in the cultivated land area changes greatly.

Development period: 1968-1995. Once production growth, and then steep rise. In this stage, Science and technology factor is the first , The influence degree of science and technology is the biggest.

Changes of food productivity within the developing period

Period of prosperity: 1996-2006. Production continues to grow steadily, total output 10 million tons of breakthrough.

Changes of food productivity within the boom period

2.2.2 Model and forecasting analysis

In this paper, the predicted content including single production, cultivated land area, population. By three predicted value that can get total output prediction. Considering some values are not reasonable, so it is necessary to process the final data again.

When using the time series model [2], some data must be processing. Considering some year's production rate mutation factor, so it is necessary to be level for the data of 1964-1967, 1993-1995, and 2001-2003 to make the image change gently and simplify the prediction model.

I The prediction **of cultivated land area**

$$A(t) = a_0 + a_1 e^{\sigma_1 t}$$

To fit the results According to the data of 2007-2010, we can maintain that the model is basic confidence (Table 1).

II Yield prediction

$$G(t) = b_0 + b_1 e^{\sigma_2 t}$$

To fit the results according to the data of 2007-2010, we can maintain that the model is basic confidence

III The forecast model of population [3]

Population prediction model using logistic model, combing the fertility rate, mortality rate, flowing factors and men and women scale factors, using the MATLAB programming, we can get prediction model equation for:

$$P(t) = c_0 + c_1 e^{\sigma_3 t}$$

To fit the results According to the population data of 2007-2010, we can maintain that the fitting is success. Prediction results (Table 2).

Table 1: Project prediction model and fitting analysis

Prediction projects	Equation of prediction model	c	p
Cultivated land area [3]	$A(t) = a_0 + a_1 e^{\sigma_1 t}$	0.41	0.8442

Per unit area yield	$G(t) = b_0 + b_1 e^{\sigma_2 t}$	0.3453	0.8622
	$P(t) = c_0 + c_1 e^{\sigma_3 t}$	0.3951	0.8872

Table 2 Prediction results of the model

Prediction methods	Cultivated land area (hm^2)		Per unit area yield of grain (kg/hm^2)		Total population (million)	
	2010	2020	2010	2020	2010	2020
Time series method	3970000	4050000	6645	7410	2176	2204
Trend Prediction [4]	4130000	4220000	6185	6654	2164	2198

The total population of 2010 is 21.0856 million in Xinjiang, the error rate is less than 3%, So we can consider that the prediction model is reasonable. In 2010 the per unit area yield of grain is 6684 kg/m3, the difference of forecast result and the actual result is not big, Then the prediction model is more reasonable.

IV Several important index predictions

Multiple index: the ratio of total crop planting area and cultivated land area in one year can be expressed as percentage, that reflect cultivated land utilization degree index. Considering the water conditions and production conditions in Xinjiang, can be think as 0.98 preliminarily.

Weight of grain: the ratio of grain crop area accounts for the total crop sowing area. Combing with the relevant national policies, It is determined that the bread than is more than 40%, So in this paper, the prediction of Xinjiang in 2010 and 2020 were 44% and 42% respectively.

V Supply and demand forecast

The relation of supply and demand is related to the future grain industry development that plays an important role to the industrial guidance. According to the national bureau of statistics of China's grain consumption standard and relevant scholars' research, our country have reached a well-off level of per capita consumption of food standard for 420 kg/people, years. But according to the reality of the data in Xinjiang, per capita grain demand respectively for 479 kg and 496 kg in 2010 and 2020.

3. Suggestions and conclusions

Agricultural sustainable development [5], Harmonious development, reasonable grain structure, Highlight brand effect

3.1.1 The difficulties of Xinjiang agricultural sustainable development

The area of desert and gobi in Xinjiang is accounted for more than 60%, the people of all ethnic groups for lived oasis economic zone is only 7 x 104 hm2, distribution in two great basin edge. The population of 95% gathered in the oasis accounts for 4% of the total area, For the productivity level and water restrictions, cultivated land area in Xinjiang since 1960 has always been at about 3.1 million ha, and the continuous cultivation just offset non-agricultural the occupation of cultivated land, no obvious increasing. As the population increasing and the per capita amount of basic agricultural production continued to decline. The occupancy of cultivated land per capita enacted by 60 s 0.4 hectares, reduced to the current 0.18 hectares, has reached a historical low level. In addition, agriculture herdsman science and technology culture quality, environmental consciousness, consciousness of sustainable development is very low, but also restricts the sustainable development of agriculture in Xinjiang.

3.1.2 Agricultural ecological environment pollution is more and more serious

Agricultural environment pollution is mainly from two aspects: one is from agriculture in excess application of chemical fertilizers, pesticides, agricultural chemicals, such as membrane pollution. The second is from agricultural external. As the urban industrial "three wastes" pollution sharply to agricultural and pastoral areas spread, the mines and factories of township enterprises "three wastes" emissions has increased rapidly, make the ecological environment by point pollution to surface pollution change. The agricultural environmental pollution at that time is difficult to manage effectively and will increase the capacity of the ecological environment pressure, serious destruction of the agricultural ecological environment, causing desertification and soil fertility decline, a direct impact on the inspecting product yield increasing and quality improvement.

Xinjiang is an arid and semi-arid region, the ecological environment was extremely fragile, together with long artificially deforestation and land clearing

overcutting and overgrazing for natural resources such as unreasonable development, utilization cause the resource in the entire district agricultural production serious destruction. One is the desertification trend accelerated; The second is sharp forest vegetation; The third is serious pasture degradation; The fourth is cheesy in water resources allocation of space and time, and the unreasonable and no harmonious use are more weighted to the destruction of the ecological environment.

The problem of water resources as the source of life of the Xinjiang oasis lies in three aspects: First, the total amount of water resources is rich, but the distribution of water resources is imbalance, seriously restricts the use of land resources in Xinjiang. Secondly, surface water is introduced , but as a result of irrigation project does not form a complete set, seepage control condition is poor, average channel utilization coefficient is 0.35-0.45 mostly, The irrigation quota of crop are two times more than actual demand about , the loss of source of water is very serious. Third, the use of inland river basin is not fair. Due to the unreasonable utilization of water resources, upstream excess water will cause the downstream oasis atrophy, rivers is shortened, and the bottom land forest decline, lakes dry up, around the oasis desertification.

3.1.3 Single industrial structure and the lagging development of non-agricultural industries

It basically behaves in: 1. planting proportion is too large. 2. Animal husbandry output value proportion is too low, and with the requirements of the development of modern agriculture of Xinjiang isn't match. 3. Forestry output value proportion is too low, agricultural ecological environment worsening situation fails to completely change. 4. The lagging development of non-agricultural industries.

3.2 The way out of Xinjiang agricultural sustainable development

3.2.1 Strictly implementing the national policy of family planning, and striving to improve the quality of the population

Because of the population is increasing rapidly, the consumption of resources is to speed up, the human resources environmental damage behavior increases, and population, resources and environment more sharp contradiction . So, it is need to pay special attention to family planning work in Xinjiang, strictly control the number of fetal birth, realize population, resources, environment, economy and society's harmonious development. To further implement the science and education "strategy, the agricultural scientific research, education and technical promotion transfer as soon as possible to adapt to the sustainable development of agriculture in the track.

3.2.2 Strengthening environmental protection and promoting the agricultural ecological system benign circulation

Strengthening environmental protection is key content to realize the sustainable development of agriculture in Xinjiang, taking the comprehensive treatment way, strengthen the rural environmental protection work. First, improve and perfect the agricultural and pastoral areas of environmental protection law enforcement supervision mechanism further and strengthen environmental law enforcement, increase law enforcement efforts, and take the environmental protection as the main content to the agricultural and pastoral areas at all levels of the government achievements appraisal. Second, the effective control of the urban industrial "three wastes" pollution to the environment. Strengthen the resources and environment dynamic monitoring and management, firmly control the new pollution source, a new industrial projects on environmental protection is "one ticket overruled ", adhere to the principle of who pollution, who management, Carry on the principle of the comprehensive governance, deadline management to the old source. Shut down the polluting enterprises. Keep with limits the curb environmental pollution from the city to the spread of agricultural and pastoral areas. Third, do a good job in water, forest, grassland and protection, to scientific and rational use of chemical fertilizers and pesticides, strengthen the agricultural film use and recovery management work, reduce the "white pollution", improve soil fertility and crop yield and quality, enhance the agricultural ecosystem stability and self-organizing ability.

3.2.3 Protecting agricultural resources, saving resources

The resource environment is fragile in Xinjiang, once damage is difficult to recover, so the utilization of resources and environmental protection must pay equal attention to, then we can guarantee the sustainable use of resources. To ensure that agricultural production and sustainable utilization of resources and ecological environment improvement is the basic premise to the agricultural sustainable development in Xinjiang. Therefore, Xinjiang agricultural development in order to maintain ecological system for productivity and function as the foundation, and the bearing capacity of resources and environment coordinate with each other, and thoroughly change the past to cultivated land "reuse light have", "over grazing and so on the wrong practices and short-term behavior, to make use of the artificial measures to promote the reproduction of cultivated land, pasture, forest land and renewable resources, maintaining the basic ecological processes and life supporting system, and maintain the diversity of ecosystem and sustainable use.

3.2.4 Optimizing the rural economic structure, accelerating the formation of dominant industries

Adjustment and optimization of the internal structure of agriculture and rural industrial structure is the inevitable trend and essential requirements to the agricultural and rural economic sustainable development,

but also is the inevitable way to agricultural production, increasing farmers' income and rural stability. One is to adjust crop production structure and production layout, changing the single grain production primarily pattern, adjust measures to local conditions to expand cotton, sugar beet, oil crops, the main crop planting area is developing to the reasonable direction. The second is through the adjustment of agriculture structure and vigorously developing animal husbandry and changing animal husbandry "short" status to make animal husbandry really become the pillar industry of the rural economy in Xinjiang. The third is to give priority to the development of township enterprises of rural secondary and tertiary industries, developing several, technology trade, agriculture integration of rural economic cooperation organization, setting up and perfect rural socialized service system, to promote the rural economic benign circulation, coordinated development to create a good condition.

3.2.5 Promote the industrialization of agriculture, improve the comprehensive economic benefits

Agricultural industrialization is not only the inevitable choice for realizing the agricultural growth mode from the extensive model to intensive model but also the effective ways to improve the agricultural comprehensive economic benefit and increase the farmers' income and lay the foundation to the sustained and rapid development for agriculture. The industrialization of agriculture is taking the market as the guide, farmers as the foundation, the leading enterprise or organization of economic cooperation as support, the economic benefits as the center and the series of service as the means, through the integration management, agricultural reproduction process before, during or after the link connection for a complete industrial system, guide the scattered household farmers into socialized production, make multiple economic benefit main body form community to better solve the production elements optimized combination and reasonable allocation of resources, agricultural specialized division of labor, the progress of agricultural science and technology, agriculture production planning and orderliness and the farmer's market risk resistance to avoid ability and prediction ability and competition ability enhancement and the market transaction cost reduction and so on, and make the agricultural production operator also conditional profit share industrial and commercial profit. The industrialization of agriculture can well balance the eco-industrial interests relations and prevent and control agricultural production factors overspeed excess loss, can well adapt to the economic development of industrialization, marketization and internationalization big trend, doesn't make the agricultural premature failure, which is beneficial to promote Xinjiang agricultural sustainable development.

3.2.6 Increasing agricultural investment, strengthening the agricultural infrastructure, improving agricultural comprehensive production capacity

Xinjiang agricultural production by natural influence is bigger, compared with many other professions, the stability is poor. Therefore, the sustainable development of agriculture is from the government's protection. In the premise for the national investment, we must increase the number and scope for the use foreign capital. To establish the diversified input mechanism taking the national, credit, the collective and the peasants as the foundation, and taking the horizontal absorption investment as the supplementary, formed an all-round attention, diversified subjects and multi-channel source of new pattern of agricultural investment, to improve the backward production conditions, add momentum to provide funding.

3.3 Countermeasures and Suggestions of the agricultural development

3.3.1 Stable oasis scale and cultivated land area, developing water-saving irrigation and lower-yield fields

Because of natural conditions in Xinjiang, the drought and soil secondary salinization become the main obstacles to the low, at the same time, forestry and ecological water are not security, and land desertification is threat to the stability of the oases in arid areas. On the other hand, the cotton exist the problem of supply exceeds demand in Xinjiang, so we should take water saving irrigation as the center, stability of cultivated land area, improving the utilization rate of cultivated land, transforming the middle-and-low-yielding fields, improving the quality of the existing cultivated land resources, improving the internal and external farmland ecological environment and ensuring the sustainable development of agriculture in Xinjiang.

3.3.2 Strengthen the popularization of agricultural technology, and establish the comprehensive agricultural development demonstration area

With the application of advanced agricultural production technology is the key to improve the level of agricultural production. Strengthening the popularization of agricultural technology is the effective measures under the condition of the economic level and quality of the labor force level are lower in Xinjiang. The Xinjiang should be established as a comprehensive agricultural development demonstration area, through the application of agriculture "six precision technology" and "ten big main technology" technology supporting assembly and a wide range of promotion, improve the comprehensive level of regional agriculture, Xinjiang will become the efficient agriculture of typical model.

3.3.3 cultivating the leading enterprises of agricultural and sideline products processing, insisting on the high starting point, pushing forward the process of the industrialization of agriculture

Xinjiang is far from the domestic and international markets, the disadvantages of high transportation cost shouldn't be overcome, and then it is greatly extinction

the competitiveness of Xinjiang agricultural and sideline products in the domestic and foreign market. So cultivating agricultural and sideline products processing leading enterprises, improving the added value of products, reducing the proportion of transportation cost in product total cost are the important link for Xinjiang agricultural and sideline products improving market competitiveness, developing the domestic and foreign market. The cultivation of the leading enterprise, must face the market, insist on the high starting point, to adopt new technology and realize upgrade of products, and improve market competitive power, strengthening brand awareness, resist market risk.

We should support emphases animal products processing leading enterprises, for the special policy of central in loans, taxation, the provincial government issued supporting policies, accelerate the development of animal products processing enterprises, so as to promote the development of animal husbandry in Xinjiang, change the development of animal husbandry in Xinjiang long-term lagging situation, promote the sustainable development of agriculture in Xinjiang, through the forming large group enterprises for cotton spinning industry, promoting the combination of the cotton spinning industry, the introduction of foreign capital, the development of joint venture enterprise, etc., Then Xinjiang will become production base of group enterprise cotton pretreating, the production base part of specializing in products.

3.3.4 Carrying out famous brand strategy

The development of Xinjiang agricultural must be carried though according to the market demand change trend, setting up the consciousness of brand, and actively developing new agricultural and sideline products and its processing products market, implementing characteristic brand strategy.

1) Government entities at all levels shall actively establish e-commerce site, release market information, introduce the local products, realize the online trade, reduce transaction cost greatly, and eliminate the restriction of space distance on Xinjiang products to domestic and international market.

2) At all levels of the government function must be transformed, and foster a sense of service, choose key products in a planned way and step by step , use a variety of media propaganda, improve and expand the awareness of the product amongst the public of the agricultural and sideline products deep processing, form famous brand product of Xinjiang.

Reference

[1] The Xinjiang Uygur Autonomous Region Statistics Bureau. Xinjiang Statistical Yearbook (1996- 2006) [M]. China Statistics Press.

[2] Liu C. Z. etc. Study on the Feasibility for the Time Series Model. China Machine Press, 1996-2005.

[3] Shi J, Zhang F.R., Zhao T. T., Spatiotemporal Changes in Cultivated Land Area in China from 1998 to 2006[J], Resources Science, 2008, 30(8):1191-1198

[4] Li M.C. etc. Prediction of china's population [M]. Renmin University of China, 1995-1999

[5] Cheng Y. Q. etc. Spatial difference and Types of Grain Sustainable Production Ability in Northeast China [J]. System Science and Comprehensive Studies in Agriculture. 2007, 23