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# Empirical Analysis of the Vegetable Industry in Hebei Province

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**Abstract** We first introduce the status quo of the development of vegetable industry in Hebei Province, and then conduct empirical analysis of the development of vegetable industry in Hebei Province. Further, we analyze the development advantage of the vegetable industry in Hebei Province using SAI (Scale Advantage Indices) and SCA (Symmetric Comparative Advantage), drawing the conclusion that the vegetable industry in Hebei Province has much room for development; at the same time, we analyze the factors influencing vegetable consumption of residents in Hebei Province through the regression model, drawing the conclusion that the vegetable consumer price index is the main factor affecting the consumption. Finally we make recommendations for the development of vegetable industry in Hebei Province as follows: increasing financial input, promoting policy guarantee capacity; implementing brand strategy, promoting the competitiveness of products; improving the ecological environment, promoting industrialization of pollution-free vegetables.

**Key words** The vegetable industry, Scale advantage Indices, Comparative advantage index, Consumer price level, Hebei Province

With the continuous development of the vegetable industry, the researches on the vegetable industry are gradually increasing, but the majority of them focus on the production and processing technologies of vegetables, for want of researches on the development of vegetable industry. Song Jianxin conducts in-depth research of the status quo and impact factors of the development of vegetable industry in Hebei Province, using the methods of personal promotion and questionnaires, combined with access to information<sup>[1]</sup>. Zeng Shanjing *et al.*, use trade competitiveness index (TC), revealed comparative advantage index (RCA), regional revealed comparative advantage index (RRCA), trade dependence, international market share (MS) and other indicators, to conduct empirical examination and test of the vegetable industry in Jiangxi Province; they find that the competitiveness of the vegetable industry in Jiangxi Province is not strong; they propose to expand the planting area, vigorously develop the characteristic vegetables, promote the processing technology and expand total exports, to improve the competitiveness of the vegetable industry in Jiangxi Province<sup>[2]</sup>. We introduce the status quo of development of the vegetable industry in Hebei Province, analyze the development advantage of the vegetable industry in Hebei Province, identify the factors affecting vegetable consumption in Hebei Province, and put forward the suggestions to speed up the development of vegetable industry in Hebei Province.

## 1 The status quo of the development of vegetable industry in Hebei Province

The vegetable industry is an important pillar industry in He-

bei Province, and the development of the vegetable industry plays a significant role in accelerating the pace of economic development and promoting the living standards of residents. The vegetable industry, as the largest cash crop industry in Hebei Province, has spawned many large-scale commodity vegetable bases. In addition to meeting local demand, the vegetable products are supplied to Beijing, Tianjin and other domestic and foreign markets. The operation of the vegetable industry in Hebei Province shows prominent development momentum, and the operating benefit of the leading enterprises and growing bases is promoted rapidly, with continuously enhanced ability to bring along. In recent years, the vegetable industry in Hebei Province develops by leaps and bounds, which has become a pillar industry for increasing agricultural output and increasing farmers' income in Hebei Province, but the vegetable production and processing base of Hebei Province is relatively weak, limiting the continuous and rapid development of the vegetable industry in Hebei Province.

### 1.1 The growing area of vegetable is relatively stable

The information of vegetable growing in Hebei Province during the period 2000 – 2009 can be seen in Table 1. Table 1 shows that from 1997 to 2003, the growing area of vegetable in whole province increased from 599 300 hm<sup>2</sup> to 1 068 500 hm<sup>2</sup>, and the yield increased from 30. 338 million t to 50. 338 million t, the growing area and yield with the average annual increase of 10. 1% and 1. 7%, respectively. In the period 2004 – 2009, the growth rate of the growing area and yield of vegetable slowed down conspicuously, with the average annual growth of 0. 3% and 1. 7%, respectively. In 2009, the growing area of vegetable was 110. 09 hm<sup>2</sup>, a decrease of 0. 04% over the previous year, and the yield was 67. 421 million t, an increase of 0. 9% over the previous year. In 2009, the benefit of the vegetable industry in whole province was enhanced, and the output value of vegetable reached 85. 07 billion yuan, accounting for 44. 1% of

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the proportion of output value of farming, ranking first in the growing industry. In terms of the planting area, it is relatively stable, and increases year by year, but it shows a downward trend in 2009. In terms of the share in the growing area of vegetable in China, the share is growing year by year, with good trend, indicating that the momentum of the development of vegetable industry in Hebei Province is good. In terms of the share in the area of crops in whole province, the share is relatively stable and experiences little change, indicating that in recent years, the development of vegetable industry has been too

much ignored in Hebei Province in the agricultural industry. In the light of the status quo of production and processing of vegetable products in Hebei Province, Hebei Province is a major vegetable-producing province, production and processing still have much room for development, with a relative comparative advantage, but the market share of vegetable products is still small, coupled with single varieties, rough processing, and simple packaging, limiting the development of the vegetable trade in Hebei Province.

**Table 1 The information of vegetable growing in Hebei Province during the period 2000 –2009**

Year	The growing area of vegetable in Hebei Province //10 <sup>4</sup> hm <sup>2</sup>	The proportion of the growing area of vegetable in Hebei Province to the growing area of vegetable in China // %	The proportion of the growing area of vegetable in Hebei Province to the growing area of all crops in Hebei Province // %	SAI	SCA
2000	86.610	5.684	9.597	0.984	-0.455
2001	92.570	5.644	10.296	0.977	-0.452
2002	102.890	5.929	11.515	1.026	-0.438
2003	106.850	5.951	12.369	1.050	-0.430
2004	108.220	6.163	12.446	1.088	-0.424
2005	110.480	6.234	12.575	1.103	-0.421
2006	106.673	6.411	12.242	1.119	-0.420
2007	107.497	6.203	12.424	1.100	-0.422
2008	110.140	6.161	12.641	1.105	-0.421
2009	110.093	5.979	12.680	1.092	-0.422

**1.2 The scale of vegetable output is very small** Comparison of the vegetable yield between Hebei Province and Shandong Province, between Hebei Province and China in the period 2000 –2009 can be seen in Table 2. Overall, apart from the

year 2006, the vegetable yield in Hebei Province is always in a state of growth, accounting for 10% of China's vegetable yield or more, but in comparison with strong vegetable province, Shandong Province, the proportion is still relatively low.

**Table 2 Comparison of the vegetable yield between Hebei Province and Shandong Province, between Hebei Province and China in the period 2000 –2009**

Year	The vegetable yield in Hebei Province //10 <sup>4</sup> t	Year-on-year growth rate // %	The vegetable yield in China //10 <sup>4</sup> t	The proportion of the vegetable yield in Hebei Province to the vegetable yield in China // %	The vegetable yield in Shandong Province //10 <sup>4</sup> t	The proportion of the vegetable yield in Shandong Province to the vegetable yield in China // %
2000	4 454.000		42 399.680	10.505	7 256.794	17.115
2001	4 892.600	9.847	48 422.360	10.104	7 556.353	15.605
2002	5 477.200	11.949	52 860.560	10.362	8 335.374	15.769
2003	5 903.400	7.781	54 032.320	10.926	8 335.374	15.427
2004	6 187.500	4.812	55 064.660	11.237	8 883.667	16.133
2005	6 467.600	4.527	56 451.490	11.457	8 606.979	15.247
2006	6 314.440	-2.368	58 325.530	10.826	8 026.412	13.761
2007	6 440.688	1.999	56 452.037	11.409	8 342.332	14.778
2008	6 684.600	3.787	57 516.000	11.622	8 634.973	15.013
2009	6 742.100	0.860	60 200.000	11.200	8 937.197	14.846

## 2 Empirical analysis of factors influencing the development of vegetable industry in Hebei Province

**2.1 SAI (Scale Advantage Indices) analysis** To learn more about the status quo of vegetable production in Hebei Province and its position in the country, we adopt SAI (Scale Advantage Indices) for measuring. SAI (Scale Advantage Indices) reflects the production scale and degree of specialization of a crop in one region, which is the result of the interaction of market demand, resource endowment, cropping systems, and

other factors. It is the index for comparing the planting area, reflecting the production scale and degree of specialization of a crop in one region from the perspective of extension. The calculation formula is as follows:

$$SAI_{ij} = \frac{HB_j / HB_i}{QG_j / QG_i}$$

where  $SAI_{ij}$  is the scale advantage index of  $j$  kinds of crops in region  $i$ ;  $HB_j$  is the planting area of  $j$  kinds of crops in region  $i$ ;  $HB_i$  is the planting area of all crops in region  $i$ ;  $QG_j$  is the planting area of  $j$  kinds of crops in China;  $QG_i$  is the planting area of all crops in China. If  $SAI_{ij} \geq 1$ , it indicates that  $j$  kinds of crops

in region  $i$  have scale advantage as against the national average, and the greater the scale index, the stronger the advantage; if  $SAI_{ij} < 1$ , it indicates that  $j$  kinds of crops in region  $i$  have no scale advantage as against the national average, and the smaller the scale index, the weaker the advantage.

According to the data by inquiry, the results obtained are listed in Table 1. Table 1 shows that the scale advantage index of the vegetable industry in Hebei Province is very prominent, and it tends to decline in recent years. In the period 2000 – 2001,  $SAI_{ij} < 1$ , but this weakness is not obvious, because it is slightly less than 1; in the period 2002 – 2006,  $SAI_{ij} \geq 1$ , it tends to rise; in the period 2007 – 2009,  $SAI_{ij} \geq 1$ , it tends to decline, thus we should attach great importance to the vegetable industry in Hebei Province, and keep the scale advantage it has.

## 2.2 SCA (Symmetric Comparative Advantage) analysis

The study by the foreign scholars finds that the biggest flaw in SAI (Scale Advantage Indices) is that its skewed distribution undermines the normal assumption in the regression test. Many foreign scholars have improved the SAI method, whose essence is to symmetrize the comparative advantage index that has been in use, with the calculation results ranging from – 1 to 1. Thus it is called Symmetric Comparative Advantage, denoted by the SCA. The calculation formula of SCA is similar to that of SAI:

$$SCA_{ij} = \frac{(HB_{ij}/HB_i) - 1}{(QG_{ij}/QG_i) + 1}$$

In general, if the symmetric comparative advantage index is greater than 0, it indicates that the degree of specialization of vegetable production in this period in the area is higher than the

national average in the same period; if the symmetric comparative advantage index is smaller than 0, it indicates that the degree of specialization of vegetable production in this period in the area is lower than the national average in the same period. Furthermore, the greater the comparative advantage index, the higher the degree of specialization.

In order to further clarify the status quo of vegetable production in Hebei Province, we also calculate the SCA index of the vegetable industry in Hebei Province, and the results are also included in Table 1. As shown in Table 1, the symmetric comparative advantage in Hebei Province is in a state of disadvantage, indicating that since the beginning of the 21st century, the degree of specialization of vegetable production in Hebei Province is lower than the national average in the same period. This shows that the vegetable industry in Hebei Province has no comparative advantage in China's vegetable industry, which requires relevant departments to attach great importance to it, so as to speed up the process of Hebei Province transforming from big vegetable province to strong vegetable province.

## 2.3 The regression analysis of vegetable consumption in Hebei Province

Hebei Province is regarded as a big vegetable producing province, and the vegetable consumption is influenced by a number of factors. Through vegetable consumer price index (S), the data concerning per capita yield of vegetable product (P), the level of consumption of residents (CS) (Table 3), we mainly analyze the relationship between vegetable consumption (Y) and three influencing factors, and establish the regression model using the least squares method, to get the degree of impact of each factor on consumption.

**Table 3 Vegetable consumption in Hebei Province during the period 2000 – 2009**

Year	Per capita vegetable consumption // kg	Vegetable consumption price index (100 in the previous year)	Per capita vegetable yield // kg	Per capita consumption level of residents // yuan
2000	61.45	102.20	670.38	2 533.00
2001	63.37	100.90	731.71	2 749.00
2002	58.78	109.20	815.43	3 081.00
2003	55.97	122.80	874.32	3 271.00
2004	57.89	94.30	911.41	3 758.00
2005	57.70	100.50	946.94	4 270.00
2006	61.61	110.90	918.55	4 924.00
2007	55.17	107.70	930.66	5 667.00
2008	59.75	109.90	959.61	6 498.00
2009	53.66	115.90	961.56	7 193.00

Using Eviews software, we get the regression equation:

$$Y = 91.6986 - 0.1405S - 0.0228P + 0.0005CS \\ (7.88384) (-1.5112) (-2.4548) (0.8160)$$

In this equation,  $R^2 = 0.7038$ ;  $D-W = 2.0789$ .

The regression results show that the vegetable consumption is negatively correlated with vegetable consumer price index and per capita yield of vegetable products (when vegetable consumer price index increases by one unit, the vegetable consumption will decrease by 0.1405 unit; when the per capita yield of vegetable products increases by one unit, the vegetable consumption will decrease by 0.0228 unit). It runs in the opposite direction as against what we usually understand (yield

increases along with increase in consumption.), because Hebei Province, adjacent to Beijing and Tianjin, is a major supply base of fresh agricultural products, and the vegetable yield increased is mainly used to supply Beijing and Tianjin; in terms of the level of residents' consumption, if the level is promoted, the vegetable consumption will rise, but the impact factor is relatively small.

The establishment of the regression model of vegetable, based on residents' consumption, is for the analysis of the market demand. To a certain extent, it has sounded the alarm to the producers. The phenomenon of supply exceeding demand is not caused by too much vegetable production, but caused by

irrational production structure of the vegetable, the impact of the price of vegetables, and vegetable varieties failing to meet the consumer demand. Producers should do a good job in market survey and research, timely adjust the production structure, plant new varieties of vegetables to meet consumer demand, determine the appropriate prices of vegetables. Only by doing these can the market supply and demand of vegetable achieve the balance in a true sense.

### 3 Conclusions and recommendations

**3.1 Conclusions** The vegetable industry plays an important role in increasing the income of farmers in Hebei Province, and promoting the adjustment of industrial structure in rural areas. The vegetable production in Hebei Province begins to translate from quantity-scale-based development mode to quality-efficiency-based development mode, but the vegetable industry involves too many parts under the management of different departments, and there are many factors influencing the vegetable industry. At the same time, the vegetable industry is affected by natural conditions and market factors. At present, the development of industry as a whole, high-quality and efficient production are facing many problems and challenges, which restrict the development of vegetable industry in Hebei Province. And the restrictions on residents' consumption amount also put the sand in the wheel of further development of the vegetable industry, therefore, we should improve the residents' income, and enhance the strength of the residents' consumption.

### 3.2 Recommendations

**3.2.1** Increasing financial input, promoting policy guarantee capacity. It should formulate preferential policies to support the development of vegetable industry, include the funds for industrial development into the provincial budget, and as the growth rate of revenue increases year by year, focus on the support to the construction of vegetables demonstration garden and seedling cultivation base, quality control, technology development and promotion, and other aspects. It should increase the input of special funds of provincial agricultural seed project into vegetable breeding, and use provincial industrialization funds to support the leading enterprises of vegetables; improve the credit guarantee and mortgage mode and guarantee mechanism to increase financial support; innovate upon insurance mechanism, and gradually expand the range of insurance pilot and types of insurance, to reduce production risk; at the same time, actively introduce and use foreign capital, strive for and mobilize the social capital, to increase investment in the vegetable industry; strengthen organizational leadership, perfect administrative management system of vegetables, improve the working body, coordinate and guide the healthy development of vegetable industry; in the main producing areas of vegetables, list the development of vegetable industry into the appraisal category of local government performance. All relevant departments should divide labor in accordance with the responsibilities, work out the measures and methods for supporting rapid development of the vegetable industry, and strengthen coordination and cooperation, to jointly promote the healthy development of the vegeta-

ble industry.

**3.2.2** Implementing brand strategy, promoting the competitiveness of products. The famous brand is the symbol of commodities with high quality, and the laissez-passer for the products to effectively enter the market and expand the market share. Creating famous brand of vegetable and implementing famous brand strategy, can determine the direction of development of the regional agricultural brand; improve standardized, planned, differentiated and characteristic vegetable brands; promote degree of trust on brand, degree of loyalty to the brand, and value-added of the brand; improve the market competitiveness and the overall competitiveness of the facility vegetable industry. For example, Dalian Changqing Agricultural Development Co., Ltd. was established in 2000, covering an area of 66.67 hm<sup>2</sup>, and since 2002, it has been the leading enterprise of agricultural industrialization in Liaoning Province; Sanxing Ecological Agriculture Co., Ltd. in Haicheng City takes the production of organic vegetable as the leading industry, which is a modern agricultural demonstration company integrating research and development of the vegetable industry, factory nursery, organic vegetable processing, and vegetable product marketing, and in 2009, it became the fourth direct procurement base of vegetables in China, first in the Northeast China, established by Wal-Mart.

**3.2.3** Improving the ecological environment, promoting industrialization of pollution-free vegetables. Development of pollution-free vegetables is the essential way to protect the ecological environment of agriculture, promote farmers' economic efficiency, ensure health and safety for consumers, and achieve sustainable agricultural development. Irrational use of chemical fertilizers, pesticides and agricultural hazardous waste, meets the quantity needs of the agricultural products, but it exerts a great impact on the agro-ecological environment, resulting in declined quality of arable land, serious nitrogen pollution of groundwater, river eutrophication, decline in the quality of farmland and air, lower quality of vegetables and other agricultural products, and other issues. It should carry out pollution-free production of vegetables, engaging in farming activities in strict accordance with the production procedures of the pollution-free vegetables; on the basis of application of high-quality organic fertilizers, rationally use fertilizer, promote and apply the low-toxicity and low-residue pesticides, biological pesticides, and prohibit high-toxicity and high-residue pesticides; promote and apply biological control, physical control, and reasonable rotation, to control pests and avoid the pollution of the ecological environment arising from improper application of pesticides, fertilizers and water. This not only saves resources, improves the quality of vegetables, but also improves the agricultural ecological environment, and ensures the sustainable development of vegetable industry.

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ses by 1 percentage point, the output will increase or decrease by 0.877 506 percentage point; the food price has the second greatest impact on the fluctuations in grain yield, and when the food price rise or fall by 1 percentage point, the output will increase or decrease by 0.113 253 percentage point; the costs of grain production and direct subsidies have little impact on grain yield, and when the costs of grain production increases or decreases by 1 percentage point, the output will increase or decrease by 0.002 262 percentage point.

## 4 Conclusions and policy recommendations

**4.1 Conclusions** The planting area of grain is the most important factor currently affecting China's grain production, with elasticity coefficient reaching 0.877 506; the food price is an important factor affecting grain yield, with elasticity coefficient reaching 0.113 253; the elasticity coefficient of grain production costs is 0.008 246, indicating that the impact of price on grain yield at the present stage is important; the elasticity coefficient of impact of direct grain subsidies on grain yield at the present stage is 0.002 262, and the impact is positive but not prominent.

The elasticity coefficient of the impact of food price is much larger than that of the impact of direct grain subsidies on grain yield. Under the existing subsidy system and level, direct grain subsidies play a positive role in increasing grain yield, but the role is limited. The basic role of increasing the food price in promoting food security can not be ignored. Therefore, the government should strengthen and improve direct grain subsidy policies; in the mean time, pay full attention to the use of market mechanism to consolidate the basic role of the food price in promoting food security to a great extent<sup>[13]</sup>.

**4.2 Policy recommendations** First, direct grain subsidies mainly give play to the role of lever. China should increase financial input into agricultural infrastructure construction; drive the development of the related investment subjects; strengthen investment in rural transport, communications, energy network construction; increase investment in irrigation and water conservancy construction; increase input to land consolidation and transformation of medium-and-low-yield field; increase investment in agricultural resources and ecological environment protection.

Second, in view of the positive impact of direct grain subsidies, China should expand the range of direct subsidies for grain production, promote the level of subsidies. It should extend subsidies to all varieties of grain, to all food producers, and promote the direct subsidies for food production to a stimulative, effective and appropriate level.

Third, China should establish the long-term mechanism of direct subsidies for grain production; incorporate the grain production subsidies into the orbit of the rule of law; improve the organizational system of food production subsidies; establish subsidy funds of grain production; levy the taxes of grain production subsidies; use the fund exclusively for its designated purpose; improve the national budget revenue and expenditure control system of food production subsidies.

Fourth, the state should improve the information-based service level of food production subsidy system, establish sound and specialized information service network platform of food production subsidy, to timely release the related information of national grain production subsidies, and provide relevant information inquiry service; carefully gather opinions and suggestions of the majority of food producers, establish and improve decision-making feedback service mechanism of the grain production subsidy policy.

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