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Research on the Supply-Side Structural Reform of Crops Based on the Model of Entropy Weight Method

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Abstract

Supply-side structural reforms in Agricultural are an important part of China's structural reforms. In which the supply-side structural reforms of food crops are related to China's food security and the matching of supply and demand markets. This paper constructs an entropy weight method model for structural reforms on the supply side of food crops, using five main food crops of rice, wheat, corn, potato, and soybeans as the research objects. The pros, cons and economic benefit are discussed in which three kinds of extreme planting structure reforms, average planting structure reforms, and percentages. According to the statistical yearbook data of Shiyan City from 2010 to 2020, MATLAB 7.0 software is used to analyze and calculate the entropy weight method model. The results show that the structural reforms of average reconstruction are the best Compared with the other two structural reconstruction modes, and it meets the needs of diversified crops cultivation. According to the averaging reconstruction method, to control Shiyan City's planted area and average output in 2019 and 2020, and only change the types of crops, the total benefits can be increased by 3.2% and 2.5% respectively. Judging from the forecast data of structural reform in 2021, the overall benefit of crops after the reconstruction of the planting area can be increased by 4.96% compared with that before the reconstruction.

Key words: Supply-side structural reform in agricultural; Food crops; Entropy weight method Model

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1. INTRODUCTION

With the continuous expansion of Chinese population size, the advancement of urbanization and the improvement of people's living standards, China's grain consumption will still maintain a rigid growth trend in the next 10 years, and the situation of medium and long-term grain supply is not optimistic. It is estimated that by 2030, the total grain consumption will be close to 760 million tons, an increase of 4% compared with 2019, and the gap between production and demand will expand from 69 million tons in 2019 to 82 million tons at the highest; among which, the consumption of cereals is about 600 million tons. ton, an increase of 27 million tons compared with 2019, the balance of production and demand will drop by at least 45%, and will be reduced to 14 million tons at most (Ban Yue Tan, 2020). Due to the opening of the two-child and third-child policies, the continuous growth of Chinese population will promote the increase in total food demand; the rapid urbanization and the continuous improvement of people's quality of life, the residents' demand for high-quality agricultural products continues to increase, and people High-quality food with high nutritional value and good for health has become a necessity, and the supply of food crops and people's growing high-quality demand have become the main contradiction at this stage. which will inevitably bring about the structural adjustment of the supply side of food crops to adapt to and Meet the dynamic changes on the food demand side. How to optimize the grain supply structure and agricultural production and operation system on the basis of the existing red line guarantee of 1.8 billion arable land, and continuously guarantee and meet the growing material needs of the people is a long-term and important task for our country.

In December 2015, the Central Rural Work Conference first proposed "agricultural supply-side structural reform", the purpose of which is to form an effective supply of agricultural products, so that the quantity, quality and variety of supply can continuously meet the growing consumer demand. The "No. 1 Central Document" in 2016 and 2017 continued to propose deepening the structural reform of the agricultural supply side, starting from the production side and the supply side, and accelerating the transformation of agricultural production methods to achieve a modern agricultural industrial system, production system and management system with high output, product safety, resource-intensive, and environmentally friendliness, and improving the quality and efficiency of the agricultural supply system as a whole.

2. LITERATURE REVIEW

How to continuously meet the market structure system of the demand side from the supply side of grain crops, scholars at home and abroad have conducted a lot of research on the structural reform of the agricultural supply side, and these research results have made beneficial contributions to the structural adjustment of grain crops in my country at this stage, mainly in the following aspects:

Research on the structural reform of agricultural supply side under the background of big data. Ding Yang (2019) applied big data technology and put forward feasible solutions to the problem of agricultural supply side structure in Shaanxi Province. By establishing an agricultural information collection system to provide information sources for big data mining, establishing agricultural big data sharing platforms and cultivating agricultural science and technology talents, etc. This approach can effectively solve its structural imbalance problem (Ding, 2019, pp.34 & 29; Ding, 2019, pp.176-180). Zhang Wei and other scholars (2018) pointed out that my country's agricultural supply side faces five major dilemmas: contradictions in grain purchase and storage, excess grain supply structure, rising production costs, information asymmetry in agricultural production, and low degree of Internet utilization. Optimize the allocation of various resources, promote the intelligentization of agricultural production, and facilitate the reform of the agricultural supply side (Zhang, 2018). Ding Wenqing (2020) believes that in order to better integrate big data, it is necessary to start from the problems existing in traditional agricultural development, improve the quality of farmers, use advanced big data agricultural management methods and introduce information-based agricultural management systems to promote the supply and demand of agricultural products. Informatization of the market (Ding, 2020). (2019) scholars believe that the effective mining of agricultural big data is more conducive to the transformation and upgrading of the existing agricultural production and operation forms, and proposes the overall strategy, talent strategy, and science and technology strategy for the development of smart agriculture (Song and Wu, 2019).

Research on the structural reform of traditional agricultural supply side. Scholars such as Wang Jiandong (2020) believe that the breakthrough of agricultural supply-side reform is to promote the development of smart agriculture, thereby providing impetus for the promotion of agricultural supply-side reform (Wang and Zheng, 2020). Yang Rou's (2018) research results based on factor input and institutional changes show that factor input brings vertical growth, and the effect lasts for a long time, while institutional change can only bring horizontal effects to a certain period, although the effect Obviously, but they are often released at one time (Yang, 2018). Song Zhenquan (2017) and others proposed to achieve green product supply, regional supply characteristics, and institutional supply sharing in view of the problems of high cost, low efficiency, and lack of international competitiveness in my country's current agricultural development (Song, et al, 2017). Tian Nengneng (2018) found that the main reasons for the agricultural socialization service system are organizational coordination and market driving, and proposed a solution based on cultivating new rural production and operation entities and implementing the Internet + agricultural management concept (Tian, 2018).

Research on the influence of agricultural internal factors on agricultural supply-side reform. Yu Xueke found that there is a contradiction between low-quality supply and high-quality demand in the research of new-type professional farmers in the agricultural supply-side reform. The core of solving such problems lies in innovating and enriching teaching methods, strengthening the construction of training bases and field schools, Optimize the teaching team and build a professional teacher database (Yu, 2019). Luo Yihong et al. (2018) found in their research on the optimization path and mechanism of agricultural product structure that at this stage, my country can guide the optimization and development of agricultural product structure through agricultural policies, improve the quality of agricultural products through technological innovation, and improve the R&D, processing and transformation capabilities of agricultural enterprises. 2. Realize the supply-side reform of agricultural products through market allocation (Luo and Yang, 2018). Jiang Zuosheng et al. (2020) based on the analysis of Huinong big data, put forward to the agricultural e-commerce users in national poverty-stricken counties that poverty alleviation in agricultural e-commerce should be based on local policies and identify advantageous agricultural industries (Jiang, 2020). Scholars such as Chen Limei (2019) conducted research on the agricultural big data service usage behavior of farmers under the rural revitalization strategy based on the mature classic integration technology acceptance model in the field of information technology, and found that my country needs to further improve the usefulness of agricultural big data in rural areas and improve agricultural To improve the quality of big data and improve the environment for the use of agricultural big data (Chen and Chen, 2019).

Research on the structural reform of agricultural supply side based on the optimization of entropy weight method. Wang Dong (2020) and other scholars used the entropy weight method to construct an evaluation system for the structural reform of the agricultural supply side from five aspects: endowment characteristics, supporting infrastructure of hard infrastructure, perfection of soft institutional environment, market competitiveness of agricultural products, and agricultural production efficiency. Identify regional differences and shortcomings, so as to better achieve regional balance and regional complementation (Wang and Bian, 2020). Lei Ling (2019), based on the entropy weight method, took the modern agricultural science and technology park as the research object, established 17 main index systems, and combined with the TOPSIS evaluation model to analyze the economic benefits of the science and technology park macroscopically, and put forward suggestions for supply-side reform (Lei and Tuo, 2019). Zhang Mengqi (2019) and other scholars took 17 prefectures and cities as the research objects, selected 8 driving factors of agricultural supply-side reform, studied the internal logic of the driving factors, and found that all factors showed a unilateral upward trend. The driving force was significantly enhanced (Zhang, Zhou and Zhou, 2019). Wang Ping (2017) and other scholars, based on the comprehensive index of agricultural supply-side reform in each province from 2001 to 2015, concluded that the supply capacity of agricultural factors in my country has been significantly enhanced. (Wang and Wang, 2017).

To sum up, scholars have conducted in-depth analysis of the agricultural supply-side reform from multiple perspectives, and provided reasonable suggestions for the structural imbalance of the agricultural supply-side. However, most of the existing studies are based on theoretical and technical means, and less research is carried out from the perspective of data analysis and model optimization. Although some scholars have studied the agricultural supply side reform based on the entropy weight method, they focus more on the construction and evaluation of the evaluation index system, and from the perspective of the agricultural supply side, the research on the imbalance of grain planting structure and the optimization of yield in my country is studied. less. Therefore, this paper intends to establish a mathematical model based on the entropy weight method, taking the main crops such as rice, wheat, corn, soybean, and potato in the counties and cities of Shiyan as the research object. The data published in the Statistical Yearbook is substituted into the model for analysis, and suggestions for the supply-side structural adjustment of the planting of five main types of grain crops are put forward. Compared with before the adjustment of the planting area after the adjustment of the supply-side structure, the plan after the adjustment of the structure can improve the economic benefits of grain planting.

3. MODEL ESTABLISHMENT

3.1 Symbol description

Table 1
Symbol Description

Symbol	Meaning	Unit
A_{ij}	A_{ij} is the planting area in the jth year of region i	HA
B_{ij}	B_{ij} is the total output in the jth year of region i	Kg
C_{ij}	C_{ij} is the average output per unit area in the jth year of region i	Kg/HA
W_i	W_i is the weight of planting dominance	
P_{ij}	P_{ij} is the proportion of the average output in the jth year of region i	
e_i	e_i is the entropy value	
K_{ij}	K_{ij} is the value of area i in the jth year	
d_i	d_i is the information entropy redundancy of region i	
z_i	z_i Comprehensive score for the area	

3.2 Model Construction

3.2.1 Model Assumptions

Assumption 1: Assumed to be the value of the planting area in the jth year of the region i, the value of the total yield of the jth year of the region i, and the value of the average yield of the jth year of the region i (i=1, 2...m; j=1 ,2...n);

Assumption 2: It is the proportion of the jth year of region i to the average output of the total region; it is the value of the average output of region i in the jth year;

$$P_{ij} = \frac{K_{ij}}{\sum_{i=1}^{n} K_{ij}} (i = 1 \ldots 9, j = 1 \ldots 11) \qquad (1)$$

Assumption 3: For ease of calculation and comparison, it may be assumed that the initial ratios for the five major crops are the same across regions and are all one-fifth.

3.2.2 Model Construction

According to the above assumptions, the entropy value of a certain crop in the construction area is:

$$\begin{cases} e_i = -\sum_{i=1}^{n} p_{ij} \ln(p_{ij}) & (i = 1, 2 \ldots m; j = 1,2 \ldots n) \quad (2) \\ e_i \geq 0 & (i = 1, 2 \ldots m) \quad (3) \end{cases}$$

The information entropy redundancy of a certain crop in area i is constructed, that is, it is used to calculate the difference between the maximum amount of information and the actual amount of information it contains:

$$d_i = 1 - e_i \quad (i=1, 2 \ldots m) \qquad (4)$$

The planting advantage weight of the construction area is a quantitative standard used to express the planting advantage. The weight is further calculated according to the redundancy. The greater the redundancy, the larger the weight, indicating that the index has a greater impact on the comprehensive evaluation. , which means that planting this crop will contribute more to the grain output of the entire region than planting other crops.

$$w_i = \frac{d_i}{\sum_{i=1}^{n} d_i} \quad (i=1,\ 2...m) \qquad (5)$$

According to the assumption, the sum of the entropy weights of the five main crops selected in each area is one, so the larger the planting advantage weight () of each crop, the higher the planting yield and planting income of this crop in this area compared to other areas. big.

According to the above model, under the premise that the total amount of crop planting area in different regions remains unchanged, after calculation according to the model, local structural adjustments are made to the planting area. If local changes occur, under the condition that the total amount remains unchanged, the economic benefits after the adjustment of the planting structure are better than those before the structure change, as shown in Figure 1.

Before refactoring						After refactoring				
	Area 1	Area 2		Area m	Reconstructing the crop planting structure (the total area of food crop planting remains unchanged)		Area 1	Area 2		Area m
Crop 1	X_1	X_2		X_n		Crop 1	X'_1	X'_2		0
Crop 2	Y_1	Y_2		Y_n	→	Crop 2	Y'_1	0		Y'_n
Crop 3	Z_1	Z_2	.....	Z_n		Crop 3	0	Z'_2	......	0
Crop 4	H_1	H_2		H_n	(Choose 2-3 crops with the highest dominance weight)	Crop 4	H'_1	0		H'_n
Crop 5	K_1	K_2		K_n		Crop 5	0	K'_2		K'_n
Total planted area	A	B		F		Total planted area	A	B		F

Figure 1
Reconstruction of supply side structure of grain crops based on entropy weight method

3.3 Indicator establishment and data acquisition

3.3.1 Establishment of food crops

With the establishment of New China, my country's agricultural production has achieved leapfrog development, the agricultural industry structure has been continuously optimized, and food crops have been greatly improved. However, with the continuous changes in my country's population and planting environment, there is still a structural imbalance in the grain structure. For example, in 2003, China's net grain export volume was as high as 19.75 million tons. In 2017, the net grain import volume reached 23.99 million tons, an increase of 85% in five years. The soybean import volume in China has risen sharply since 1996. In 2017, the soybean import volume reached 95.53 million tons. The continuous growth of demand for agricultural products will make my country face the problem of insufficient food supply and demand for a long time (China Development Research Foundation, 2019).

In order to solve the structural imbalance of grain crops in my country, evaluate the advantageous indicators of regional grain planting, reconstruct the layout of regional grain crops by calculating the dominant indicators through the model, reconstruct the planting area of grain crops scientifically, and achieve the optimal yield and economic benefits of regional grain crops. The five most important food crops in my country, such as rice, wheat, corn, potato, and soybean, are the research objects. The advantage ratio of regional food crops is evaluated through the weight of crop planting advantages and regional planting advantages, so as to reconstruct the planting structure of food crops. To achieve the goal of increasing grain income and improving economic benefits.

3.3.2 Data acquisition

As a contiguous impoverished mountainous area in the Qinba region, Shiyan City is a representative of many mountain agriculture in my country. The research on the structural optimization of grain crops in Shiyan mountainous area has certain universality, and has a certain reference for other similar mountainous areas. According to the planting area and types of crops in Shiyan, five main crops are selected as representatives: rice, wheat, corn, potato and soybean. The planting area of these five crops accounts for more than 89% of the total planting area of main crops in Shiyan City. It represents the main food crops in Qinba region. The data used in the research and calculation in this paper come from public data such as Shiyan City Statistical Yearbook and Hubei Yearbook from 2010 to 2020 in Shiyan City, Hubei Province, and are authoritative and authentic.

4. EMPIRICAL ANALYSIS OF THE SUPPLY-SIDE STRUCTURAL REFORM OF CROPS IN SHIYAN

In order to scientifically analyze the planting benefits of grain crops in Shiyan City and provide a decision-making basis for the structural reform of crops, according to the entropy weight method model constructed above, through MATLAB 7. Show.

It can be seen from Table 2 that for the districts and counties in Shiyan City, the suitable areas for rice cultivation are Maojian District, Zhangwan District, Yunyang District and Fang County, and the suitable areas for wheat cultivation are Zhushan County, Danjiangkou City and Shiyan City, which are suitable for planting rice. The areas suitable for corn are Zhuxi County, Danjiangkou City, and Shiyan City; the areas suitable for potato cultivation are Maojian District, Yunxi County, Zhuxi County, and Fang County; the areas suitable for soybean cultivation are Zhangwan District, Yunyang District, and Yunxi County, Zhushan County.

Table 2
The weights of planting advantages of main crops in various regions of Shiyan City (W_i)

	Rice	Wheat	Corn	Potatoes	Soybean
Maojian District	0.2493*	0.1737	0.1612	0.2709*	0.1448
Zhangwan District	0.2350*	0.2115	0.1593	0.1407	0.2534*
Yunyang District	0.2734*	0.2068	0.0927	0.1466	0.2805*
Yunxi County	0.1123	0.1915	0.1904	0.2358*	0.2701*
Zhushan County	0.1112	0.2317*	0.2264	0.1953	0.2354*
Zhuxi County	0.1426	0.1539	0.2446*	0.2441*	0.2147
Fang County	0.2604*	0.2319	0.1162	0.2377*	0.1537
Danjiangkou	0.1453	0.2493*	0.3109*	0.1502	0.1443

*Indicates the two most suitable crops for growing in this area

4.1 Comparison of economic benefit forecast before and after the structural reconstruction of the supply side of grain crops in Shiyan City in 2021

4.1.1 Prediction of average yield per unit area before the structural reconstruction of the supply side of grain crops in 2021

Based on the 2010-2020 Shiyan City Statistical Yearbook data on planting yields in various regions, according to the principle of the moving weighted average method, and using MATLAB programming to calculate the predicted yields of crops planted in various regions in 2021 as shown in Table 3:

4.1.2 2021 forecast of total output of grain crops in Shiyan City before structural reconstruction of supply side

According to Table 3, the total output before the adjustment of crop structure in 2021 is calculated, as shown in Table 4. Because each crop type is different, the unit yield is different, so a unified unit of measurement is required. Here, the average of the ten-year average yield of each crop from 2010 to 2020 is used as the benchmark score. 1 point per 7,989 kilograms, 1 point per 2,681 kilograms of wheat, 1 point per 4,188 kilograms of corn, 1 point per 3,637 kilograms of potatoes, and 1 point per 1,987 kilograms of soybeans. The score of each crop is divided by the total yield of the crop and the average yield, and the total score is the sum of the scores of various crops, which is used to represent the comprehensive value of food crops in the region.

Table 3
Forecast of average crop yield per unit area in 2021 (kg/ha)

	Rice	Wheat	Corn	Potatoes	Soybean
Maojian District	7995.0	2590.3	3464.3	3598.0	2279.2
Zhangwan District	6210.3	2771.6	3424.3	3667.8	1604.0
Yunyang District	8247.7	3146.3	3932.3	3829.6	1916.8
Yunxi County	7841.0	2726.5	3630.2	3607.0	1561.7
Zhushan County	8270.0	2853.7	3891.6	3739.0	1708.7
Zhuxi County	8304.6	2986.3	6839.7	3603.7	1723.0
Fang County	8270.7	2708.6	3713.5	3705.0	1682.0
Danjiangkou	8155.6	2789.0	3506.6	3202.3	1477.3

Table 4
The total output before the reform of crop planting structure in Shiyan City (kg)

	Rice	Wheat	Corn	Potatoes	Soybean
Maojian District	80.0	232.8	659.2	108.1	90.9
Zhangwan District	124.3	277.6	926.4	219.9	64.2
Yunyang District	40882.5	70615.3	62688.8	17681.7	2955.5
Yunxi County	15916.6	30893.3	45923.9	23941.9	4076.7
Zhushan County	42243.9	20909.6	48917.1	25695.6	7385.5
Zhuxi County	42746.8	12393.9	74380.4	34350.1	7166.5
Fang County	39612.7	5756.8	41494.4	7675.1	1878.5
Danjiangkou	35972.8	25198.4	20460.7	8768.3	1179.1
Total	217579.6	166277.6	295450.9	118440.8	24796.8
Average amount of credit	7989	2681	4188	3637	1987
Score	27.2	62.0	70.5	32.6	12.5

According to the model formulas (1) to (5), the total score of agricultural products planted before the reform of the crop planting structure in Shiyan City in 2021 is calculated as: 204.86 points.

4.1.3 2021 forecast of total output after the structural reconstruction of the supply side of grain crops in Shiyan City

According to the model constructed by the entropy weight method, the structure of the existing grain crops in Shiyan City is adjusted. In order to find a better reform method, three reform models are adopted. The first one adopts extreme prediction, that is, each area is only planted in that area. The crop with the greatest advantage; the second adopts the average prediction, that is, the crops with the top two planting advantages are planted in each region, and the planting area is the same; the third adopts the entropy weight percentage method, that is, the crops with the top two planting advantages are selected. , according to the percentage of the planting advantage entropy weight of the two crops, the planting area is allocated proportionally. The results of the three prediction methods are shown in Table 5.

Table 5
Forecast of crop yield in Shiyan City in 2021 (kg)

	Soybean			Potatoes			Corn		
	Percentage	Averaging	Extreme	Percentage	Averaging	Extreme	Percentage	Averaging	Extreme
Maojian District	0	0	0	666	629	1259	0	0	0
Zhangwan District	401	384	769	0	0	0	0	0	0
Yunyang District	49502	48618	97237	0	0	0	0	0	0
Yunxi County	30991	28695	57391	60976	66278	0	0	0	0
Zhushan County	33066	33066	66133	0	0	0	0	0	0
Zhuxi County	0	0	0	68307	68307	0	129645	129645	259291
Fang County	0	0	0	38172	39921	0	0	0	0
Danjiangkou	0	0	0	0	0	0	46012	40817	81634
Total	113961	110765	221531	168123	175137	1259	175657	170462	340925
Average amount of credit	1987	1987	1987	3637	3637	3637	4188	4188	4188
Score	57.35	55.74	111.49	46	48	0.34	41	40	81
Total Score	214.59	215.02	215.55						

	Wheat			Rice		
	Percentage	Averaging	Extreme	Percentage	Averaging	Extreme
Maojian District	0	0	0	1283	1364	0
Zhangwan District	0	0	0	1428	1490	0
Yunyang District	0	0	0	205479	209284	0
Yunxi County	0	0	0	0	0	0
Zhushan County	55246	55246	0	0	0	0
Zhuxi County	0	0	0	0	0	0
Fang County	0	0	0	94572	89116	178232
Danjiangkou	28332	32463	0	0	0	0
Total	83579	87710	0	302763	301255	178232
Average amount of credit	2681	2681	2681	7989	7989	7989
Score	31	32	0	37	37	22
Total Score						

(1) Extreme reconstruction

According to the prediction of extreme reconstruction, the total score of agricultural products grown in Shiyan City in 2021 will be 215.55 points. It is calculated that the planting in Shiyan City in 2021 will be 204.86 points. According to extreme planting, the planting benefit can be increased by 5.22%, but extreme reconstruction, almost no other food crops are planted, can not meet the requirements of diversified planting of crops, and does not meet the actual planting situation.

(2) Average reconstruction

It can be seen from Table 5 that the averaged reconstruction prediction score is 215.02, which is slightly less than the extreme prediction score, but the averaged prediction of all crops has a balanced yield and can meet the requirements of crop diversification. According to the average planting, the planting benefit can be increased by 4.96%. Taking rice as an example, in 2021, the average yield per unit area of rice will be 8,238.89kg/ha after the planting structure is averaged and reconstructed, and 8,216.75kg/ha before reconstruction, an increase of 22.14kg per hectare.

(3) Percent reconstruction

As can be seen from Table 5, the score obtained by the percentage reconstruction prediction is 214.59 points, which is lower than the average and extreme predictions, so the averaged planting method is slightly better than the percentage planting method.

To sum up, the most suitable method for average crop planting is the most suitable method for Shiyan City, which can not only improve the economic benefits of planting, but also satisfy the diversified planting of crops, which is 4.96% higher than the overall benefit before the reform.

4.2 Average planting comparison in Shiyan City in 2019-2020

According to the actual production data from 2019 to 2020, the total planting area and average yield are kept unchanged, and only the planting area of different crops is reconstructed. The overall crop planting scores in Shiyan City after optimization are calculated according to the model. The specific scores in 2020 are shown in Table 6.

Table 6
Average forecast of total crop yield in 2020

	Rice	Wheat	Corn	Potatoes	Soybean
Maojian District	1365	0	0	611.625	0
Zhangwan District	1522	0	0	0	378
Yunyang District	210485	0	0	0	47578
Yunxi County	0	0	0	68355	30778
Zhushan County	0	56628	0		33396
Zhuxi County	0	0	73761	67663	0
Fang County	88408	0	0	39598	0
Danjiangkou	0	32999	40332	0	0
Total	301782	89627	114094	176227	112130
Average amount of credit	7989	2681	4188	3637	1987
Score	37.77	33.43	27.24	48.45	56.43

According to the average forecast structure, the score of Shiyan City in 2020 after the optimization is 203.4, an overall increase of 2.5% compared with the score of 199 before optimization. In the same way, according to the method of this type of planting structure reform, it is calculated that the overall growth rate in 2019 will be 3.2%. Taking the grain crop rice as an example, the average yield per unit area before the planting structure reform in 2019 was 8232.65kg/ha, and after the reform was 8250.36kg/ha. , In 2019, the yield of rice increased by 17.71kg per hectare. Before the reform of the planting structure in 2020, the average yield per unit area was 8241.84kg/ha. After the reform, the average yield per unit area increased to 8253.31kg/ha. In 2020, the yield of rice per hectare increased by 11.47kg.

4.3 Suggestions on the cultivation of grain crops in various regions of Shiyan

Through the comparison of the values before and after the optimization of the grain crop planting structure in Table 1 to Table 6, the advantages of planting grain crops are different in each district and county in Shiyan City. See Table 7 for a summary of crops:

For the entire Shiyan City as a whole, the most suitable main crops for planting are corn and wheat, which account for more than 50% of the total entropy weight. Compared with grain crops, the areas suitable for growing rice are Maojian District, Yunyang District and Fang County; the areas suitable for growing wheat are Zhushan County, Fang County and Danjiangkou City; the areas suitable for growing corn are Zhushan County, Zhushan County, Zhushan County Xi County and Danjiangkou City; the areas suitable for potato cultivation are Zhuxi County and Fang County in Maojian District; the areas suitable for soybean cultivation are Zhangwan District, Yunyang District and Yunxi County.

Table 7
Planting suitability of crops in Shiyan City

	Rice	Wheat	Corn	Potatoes	Soybean
Maojian District	√			√	
Zhangwan District					√
Yunyang District	√				√
Yunxi County					√
Zhushan County		√	√		
Zhuxi County			√	√	
Fang County	√	√		√	
Danjiangkou		√	√		

(√ means that the crops are suitable for planting in this area)

Based on the above analysis, compared with Shiyan City, Maojian District is suitable for planting rice and potatoes; Zhangwan District is suitable for planting soybeans; Yunyang District is suitable for planting rice and soybeans; Yunxi County is suitable for planting soybeans; Zhushan County is suitable for planting soybeans; It is suitable for planting wheat and corn; Zhuxi County is suitable for planting corn and potatoes; Fang County is suitable for planting rice, wheat and potatoes; Danjiangkou City is suitable for planting wheat and corn.

5. CONCLUSION AND OUTLOOK

In this paper, an entropy weight method model for the structural reform of the supply side of grain crops is constructed, and the five main crops of rice, wheat, corn, potato and soybean in the Qinba area of Shiyan, Hubei Province are taken as the research objects. According to the entropy weight method model, the data is calculated and analyzed by Matlab software, and the following conclusions are obtained:

First, for Shiyan City as a whole (three districts, four counties and one city), the most suitable food plants are corn and wheat. Compared with other regions, Maojian District is the most suitable for potato planting, and Zhangwan District is the most suitable for planting potatoes. Soybeans are grown in Yunyang District, rice is grown in Yunxi County, soybeans are grown in Zhushan County, corn is grown in Zhuxi County, and rice is grown in Fangxian County. Danjiangkou City is the most suitable for growing corn. In Shiyan's future grain crops, soybean, corn and wheat are the three main crops as the main direction of supply-side structural reform. Second, according to the data analysis of extreme reconstruction prediction, average reconstruction prediction and percentage reconstruction prediction, the three methods of planting reconstruction in Shiyan City have the best overall effect of average reconstruction. This method can avoid The problem of structural imbalance in crop diversity caused by extreme planting is also higher than that of planting based on percentage reconstruction. If the planting is based on average reconstruction, the comprehensive benefit of Shiyan City after reconstruction in 2021 can be increased by 4.96% compared with that before reconstruction. Taking rice as an example, the yield of rice per hectare can be increased by 22.14 kg before and after reconstruction. Therefore, the average reconstruction of planting can be used as a reference direction for the structural reform of the supply side of crops in Shiyan City in the future. Third, according to the entropy weight method model, all districts and counties in Shiyan City adopt the structural reform of optimizing planting on average. From 2019 to 2020, the planting efficiency can be increased by 3.2% and 2.5% respectively. Taking rice as an example, the yield per unit area can be increased respectively in two years. 17.71kg/ha, 11.47kg/ha.

With the continuous deepening of the structural reform of my country's agricultural supply side and the continuous optimization of the planting method and structure of grain crops, my country's grain output and economic benefits will show a rising trend, which will surely slow down the growth trend of my country's grain crop imports. In the future, the trend of grain import will definitely be turned into a decline, which will fundamentally solve the problem of food supply in short supply.

REFERENCES

Ban Yue Tan (2020, November 26). *Policy Suggestions on my country's Mid- and Long-Term Grain Supply and Demand Situation and Response* [DB/OL]. Retrieved from https://www.sohu.com/a/434456831_118900

Chen, L. M., & Chen, D. P. (2019). Research on the use behavior of farmers' agricultural big data services under the rural revitalization strategy - based on the micro data of 973 farmers. *Journal of Nanjing Normal University (Social Science Edition), 06,* 123-132.

China Development Research Foundation. (2019). *Transforming Sannong: Challenges and Countermeasures of Agricultural Supply-side Structural Reform*. Beijing: China Development Press.

Ding, W. Q. (2020). Application of big data fusion in agricultural supply side reform. *Electronic World, 15*, 69-70.

Ding, Y. (2019). Research on the structural reform of agricultural supply side in Shaanxi Province under the background of big data. *New West China (late issue), 34*(7), 29.

Ding, Y. (2019). Research on the structural reform of agricultural supply side under the background of big data: Taking Shaanxi Province as an example. *Hubei Agricultural Science, 58*(18), 176-180.

Jiang, Z. S., Tang, W. F., Li, B. B., & Gu, W. J. (2020). Analysis of agricultural e-commerce users and operations in national-level poverty-stricken counties—Analysis based on big data for farmers. *China Agricultural Resources and Zoning, 41*(07), 224-232.

Lei, L., & Tuo, X. X. (2019). Evaluation of Comprehensive Innovation and Development Capability of Shaanxi Modern Agricultural Science and Technology Park Based on Supply-side Structural Reform--A Model Based on the Combination of Entropy Weight Method and TOPSIS. *Science and Technology Management Research, 39*(03), 114-120.

Luo, Y. H., & Yang, Y. (2018). Analysis of the optimization path and mechanism of my country's agricultural product structure under the supply-side reform. *Agricultural Economics, 03*, 47-48.

Song, W., & Wu, X. (2019). Big data boosts the development of smart agriculture. *People's Forum, 12,* 100-101.

Song, Z. Q., Song, Y., Yu, Y. R., & Wang, H. X. (2017). Agricultural supply-side reform from the perspective of market economy: historical mirror, generative logic and dilemma solution. *Jiangsu Agricultural Science, 45*(19), 14-17.

Tian, N. N. (2018). *Research on the Reform Motivation and Development Path of Agricultural Socialization Service System under the Supply-side Structural Reform* [Doctoral dissertation, Nanjing University of Finance and Economics].

Wang, D., & Bian, Z. Q. (2020). Evaluation of the ability of agricultural supply-side structural reform and analysis of its income-increasing effect: Based on the perspective of new structural economics. *Journal of Southwest University for Nationalities (Humanities and Social Sciences Edition), 41*(12), 122-132.

Wang, J. D., & Zheng, C. l. (2020). Research on Smart Agriculture Boosting the Structural Reform of Agricultural Supply Side. *Fujian Computer, 36*(12), 116-117.

Wang, P., & Wang, Q. (2017). Regional Capability Differences and Improvement of Agricultural Supply Side Structural Reform. *Economist, 04*, 89-96.

Yang, R. (2018). *Research on the influencing factors of China's agricultural growth under the background of supply-side structural reform* [Doctoral dissertation, Shandong University of Finance and Economics].

Yu, X. k. (2019). *Research on the cultivation path of new professional farmers under the supply-side reform* [Doctoral dissertation, Southwest University].

Zhang, M. Q., Zhou, X., & Zhou, Y. X. (2019). Analysis of regional differences in the driving forces of agricultural supply side reform in Shandong Province. *Journal of Shandong Agricultural University (Social Science Edition), 21*(03), 106-111.

Zhang, W. (2018). Research on the structural reform of my country's agricultural supply side from the perspective of "Internet +". *Gansu Social Sciences, 03*, 116-122.