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Evaluation on Explicit Dominance of Production and Development of Crops Based on Theory of Comparative Advantage – A Case Study of Wengyuan County

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Abstract This article offers an overview of crop production in Wengyuan County: the growing area of rice is the biggest followed by sugarcane and the growing area of mulberry, Sanhua plum and Jiuxian peach is small; the annual output of sugarcane is the biggest followed by rice, the annual output of mulberry ranks NO.3, and the output of Sanhua plum and Jiuxian peach is the lowest, but the annual output of them is very close. In accordance with evaluation indicator system concerning explicit dominance of production and development of crops, coupled with data analysis, we determine the explicit dominance of the main crops in Wengyuan County. The results show that the normalized explicit dominance of rice, sugarcane, mulberry, Sanhua plum and Jiuxian peach in Wengyuan County is 0.23, 0.94, 0.33, 0.22 and 0.46, respectively; in Wengyuan County, the sugarcane is fit to expand the scale, the mulberry and Jiuxian peach are relatively fit to expand the scale, and the rice and Sanhua plum are not fit to expand the scale.

Key words Comparative advantage, Explicit dominance of production and development of crops, Evaluation system, Wengyuan County

The comparative advantage of regional agricultural products is the market potential of one region in one country which can produce and provide agricultural products with low complete cost and market competitiveness for domestic or international market of agricultural products^[1]. The comparative advantage of agricultural products can be divided into the comparative advantage in resource endowments, the comparative advantage in production area and the comparative advantage in circulation area. The current analysis of resource endowments generally remains in the qualitative analysis, while the quantitative analysis mainly concentrates in areas of production and circulation^[2]. The explicit dominance of production and development of crops is the adaptability of production of one crop to the existing overall conditions of ecology, economy and society within one region and its functional performance, and an important quantitative indicator judging whether the development of this crop should be expanded or not in the adjustment of industrial structure, reflecting the mutual coordination and harmony between real crop production and integrated regional environmental conditions^[3].

Currently, due to changes in market demand and other factors, the agriculture in Wengyuan County is in urgent need of industrial restructuring. According to the evaluation of explicit dominance of crops, comparing the explicit dominance of the major crops, is of great significance to the adjustment of industrial structure. Based on the analysis of overview of agricultural development in Wengyuan County, this article refers to the evaluation indicator system of explicit dominance of production and development of crops advanced by Zhu Liquan, and uses this indicator system to evaluate the major crops in Wengyuan

County, in order to provide judgment basis for the adjustment of agricultural structure.

1 Overview of crop production in Wengyuan County

Wengyuan County is located in the southeast of Shaoguan City in Guangdong Province, east connecting Lianping County, south bordering Xinfeng County, west abutting Yingde City and Qujiang District, and north neighboring on Shixing County and Jiangxi Province. It has a population of 0.388 million and an area of 2 234 km², having jurisdiction over 7 townships and 156 village committees. The terrain is mainly mountain and basin, and it is the Central Asian tropical monsoon climate, with average temperature of 20.4 °C, annual rainfall of 1 778 mm, and frost-free period of 312 d. The crops mainly include rice, vegetables, sugarcane, peanuts, and soy. Sanhua plum, Liuli orange, Jiuxian peach and other fruits are well-known. It is "Hometown of Sanhua Plum in China", "Hometown of Jiuxian Peach in China" and "Hometown of Orchid in China".

Rice is the main food crop; sugarcane and mulberry are the main cash crops; Sanhua plum and Jiuxian peach are the most famous characteristic fruits in Wengyuan County. They are the main crops in Wengyuan County, and the annual growing area and output can be seen in Fig. 1 and Fig. 2.

Fig. 1 shows that in Wengyuan County, the growing area of rice is the biggest followed by sugarcane and the growing area of mulberry, Sanhua plum and Jiuxian peach is small. The growing area of rice decreased in 2001; after reaching the lowest value in 2003, the growing area of rice increased rapidly; after 2006, the growing area of rice tended to be gentle, with little change. The growing area of sugarcane, mulberry, Sanhua plum and Jiuxian peach changes little.

Fig. 2 shows that the annual output of sugarcane is the biggest followed by rice, the annual output of mulberry ranks NO. 3, and the output of Sanhua plum and Jiuxian peach is the lowest, but the annual output of them is very close. In the period 2001 – 2010, the annual output of sugarcane changed sharply. It first increased rapidly, reached its maximum in 2006, then decreased afterwards. In 2009, the annual output increased significantly again. The annual output of rice declined slightly, but the annual output of mulberry, Sanhua plum and Jiuxian peach changed little.

2 Evaluation of explicit dominance of production and development of crops

The explicit dominance of crop production often includes 4 parts: the comparative advantage of crop production and situa-

bility of regional environmental conditions, namely the explicit dominance of ecology; the comparative advantage of economic benefit of crop production under regional integrated environmental conditions of nature and society, namely the explicit dominance of economy; the comparative advantage of degree of meeting social needs and labor absorption on the part of crop production in the region, namely the explicit dominance of society; the comparative advantage of integrated adaptability of crop production to the environment in the region, namely comprehensive explicit dominance of region^[3].

2.1 Establishment of indicator system By referring to the research by Zhu Liqun and other experts^[3], the evaluation indicator system of explicit dominance of production and development of crops can be shown in Table 1.

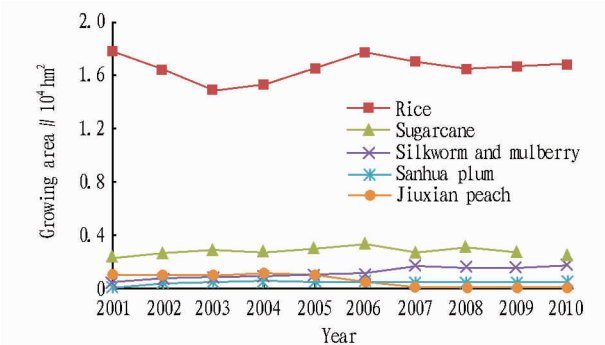


Fig. 1 The growing area of rice, sugarcane, silkworm and mulberry, Sanhua plum and Jiuxian peach in Wengyuan County

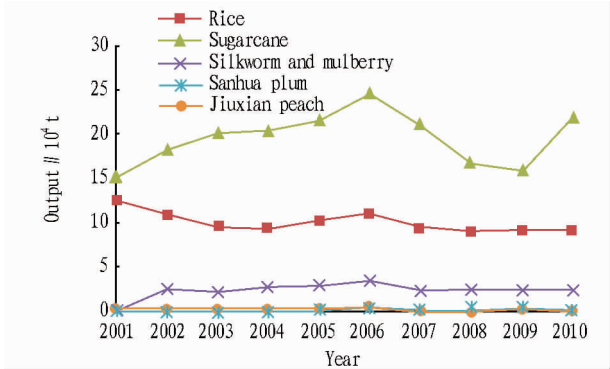


Fig. 2 The annual output of rice, sugarcane, silkworm and mulberry, Sanhua plum and Jiuxian peach in Wengyuan County

Table 1 The evaluation indicator system of explicit dominance of production and development of crops

The first-level indicator	The second-level indicator	The third-level indicator
The explicit dominance of production and development of crops	The explicit dominance of ecology	Yield rate of land resources Yield rate of water resources Conversion and utilization rate of nutrients The loss amount of fertilizer Pesticide consumption Emission intensity of greenhouse gas
	The explicit dominance of economy	Labor margin rate Land margin rate Cash margin rate
	The explicit dominance of society	Indicator of meeting social needs Labor absorption indicator
	The comprehensive explicit dominance of region	Planting scale indicator Irrigation scale indicator Labor scale indicator

2.2 Selection of evaluation method

2.2.1 Calculation of single-indicator dominance. The calculation formula of single-indicator dominance is as follows:

EA_{ijk} = \frac{A_{ijk}}{A_{jkmax}} \tag{1}

where A_{jkmax} signifies the maximum of term k evaluation indicator of all crops in sub-unit j.

2.2.2 Explicit dominance of production and development of crops. The calculation formula of explicit dominance of production and development of crops is as follows:

EAI_{ij} = \frac{1}{n} \sum_{k=1}^n EA_{ijk} \tag{2}

where EAI_{ij} is composite index of explicit dominance of crop i in sub-unit j; n is the number of evaluation indicator of single crop.

2.3 Evaluation of explicit dominance of crops According to related output data from 2010 *National Economic and Social Development Statistics Bulletin in Wengyuan County*^[4], and *National Economic Statistics of Wengyuan County in Guangdong Province* in the period 2001 – 2007^[5] (Table 2), we calculate the evaluation results of crop explicit dominance in Wengyuan County using formula (1) and (2) (Table 3 – 5).

Table 2 Original data of crop production in Wengyuan County

Crops	Area hm ²	Output kg/hm ²	Net margin Yuan /hm ²	Fertilizer consum- ption// kg/hm ²	Nitrogenous fertilizer consumption //kg/hm ²	Phosphate fertilizer consumption// kg/hm ²
Rice	16 824.20	5 472.60	11 205	975	375	375
Sugarcane	2 437.33	89 932.35	12 975	1 500	750	750
Silkworm and mulberry	1 711.07	14 697.15	4 260	750	375	375
Sanhua plum	421.53	3 610.65	6 840	270	135	135
Jiuxian peach	21.40	12 289.65	16 500	270	135	135

Crops	Pesticide consumption kg/hm ²	Irrigation amount m ³ /hm ²	The amount of human labor// person/hm ²	Cash cost Yuan/hm ²	Per capita consumption// kg
Rice	30	10 005	112.5	4 770	140
Sugarcane	30	1 200	300.0	6 195	8
Silkworm and mulberry	30	900	375.0	3 000	0.009
Sanhua plum	30	1 050	375.0	300	80
Jiuxian peach	30	1 050	375.0	300	90

Table 3 Calculation results of indicators concerning explicit dominance of crops in Wengyuan County

Crops	Yield rate of land resources	Yield rate of water resources	Conversion and utilization rate of nutrients	The loss amount of fertilizer	Pesticide consumption	Emission intensity of greenhouse gas	Labor margin rate
Rice	364.84	0.55	5.61	11.70	2.00	1.31	99.60
Sugarcane	5 995.49	74.94	59.95	46.80	2.00	1.63	43.25
Silkworm and mulberry	979.81	16.33	19.60	11.70	2.00	1.31	11.36
Sanhua plum	240.71	3.44	13.37	1.52	2.00	1.11	18.24
Jiuxian peach	819.31	11.70	45.52	1.52	2.00	1.11	44.00
Crops	Land margin rate	Cash margin rate	Indicator of meeting social needs	Labor absorption indicator	Planting scale indicator	Irrigation scale indicator	Labor scale indicator
Rice	747.00	2.35	1.65	7.50	0.08	0.000 011	0.000 2
Sugarcane	865.00	2.09	7.81	20.00	0.01	0.000 001	0.000 6
Silkworm and mulberry	284.00	1.42	509.47	25.00	0.01	0.000 001	0.000 8
Sanhua plum	456.00	22.80	0.05	25.00	0.00	0.000 001	0.000 8
Jiuxian peach	1 100.00	55.00	0.23	25.00	0.00	0.000 001	0.000 8

Table 4 Calculation results of single-indicator dominance of crops in Wengyuan County

Crops	Yield rate of land resources	Yield rate of water resources	Conversion and utilization rate of nutrients	The loss amount of fertilizer	Pesticide consumption	Emission intensity of greenhouse gas	Labor margin rate
Rice	1.00	0.01	1.00	0.25	1.00	0.81	1.00
Sugarcane	16.43	1.00	10.68	1.00	1.00	1.00	0.43
Silkworm and mulberry	2.69	0.22	3.49	0.25	1.00	0.81	0.11
Sanhua plum	0.66	0.05	2.38	0.03	1.00	0.68	0.18
Jiuxian peach	2.25	0.16	8.11	0.03	1.00	0.68	0.44
Crops	Land margin rate	Cash margin rate	Indicator of meeting social needs	Labor absorption indicator	Planting scale indicator	Irrigation scale indicator	Labor scale indicator
Rice	0.68	0.04	0.003 2	0.30	1.00	1.00	0.30
Sugarcane	0.79	0.04	0.015 3	0.80	0.14	0.12	0.80
Silkworm and mulberry	0.26	0.03	1.000 0	1.00	0.10	0.09	1.00
Sanhua plum	0.41	0.41	0.000 1	1.00	0.03	0.11	1.00
Jiuxian peach	1.00	1.00	0.000 4	1.00	0.00	0.11	1.00

Table 5 Classification results of explicit dominance of production and development of crops in Wengyuan County

Crops	Explicit dominance	The normalized explicit dominance	Level classification
Rice	0.60	0.23	Not fit to expand the scale
Sugarcane	2.45	0.94	Fit to expand the scale
Silkworm and mulberry	0.86	0.33	Relatively fit to expand the scale
Sanhua plum	0.57	0.22	Not fit to expand the scale
Jiuxian peach	1.20	0.46	Relatively fit to expand the scale

economic development is the inevitable result, and the law of adjustment of agricultural structure takes shape in contradiction between adaption and maladaptation. But the adjustment must be based on achieving agricultural economic growth as the most fundamental goal, because there is a close relationship between agricultural economic growth and agricultural structure, and adjustment of agricultural structure is bound to be beneficial to the growth of the agricultural economy.

3.2 Countermeasures When conducting adjustment of agricultural structure in Xinjiang, we should take the Twelfth Five-Year Plan of Xinjiang Autonomous Region as guidance, the construction of new socialist countryside as center. Based on the actual situation of Xinjiang, the following countermeasures and proposals are put forward.

3.2.1 Adjust the industrial structure steadily, address the industry convergence and broaden the income-increase channels for the farmers. The income from farming in Xinjiang is still one of the major sources of agricultural revenue in Xinjiang. For the adjustment of farming, we should take farming as the leading industry based on the actual situation of all regions, and vigorously develop the cash crops in line with the situation of local natural resources. For the fruit industry, we should lay stress on the adjustment of structure of the fruit industry in Xinjiang, because the development of the fruit industry is of great significance to promoting the development of agriculture in Xinjiang, and increasing farmers' income. For the adjustment of animal husbandry and fishery, based on existing development status, we should introduce and improve high-quality livestock varieties, and enhance the overall grade of livestock products in Xinjiang.

3.2.2 Strengthen the input to adjustment of agricultural structure. As the development level of the agricultural economy is low, and the economic capacity is weak, so in the process of adjustment of agricultural structure in Xinjiang, we must increase the input to adjustment of agricultural structure. These inputs mainly include preferential policies, capital input, and

technology input. At the same time, we must strive to improve the quality of the rural population, increase investment in rural education, and promote rural human capital. In the final analysis, we should strive to improve the quality of the rural population, in order to propel the strategic adjustment of agricultural structure and improve the quality of agricultural products and market competitiveness.

3.2.3 Stick to the combination of internal adjustment and external adjustment of agricultural industry. With the continuous adjustment of agricultural structure and constant extension of industrial chain accompanied by the adjustment, the external role of agriculture becomes more and more obvious. This role will restrict or promote the adjustment of agricultural structure, therefore, the development of agriculture is far from enough, and we must coordinate the development of entire economy in society.

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3 Conclusions

We normalize different explicit dominance indices of production and development of crops (Table 5). By observing the data distribution characteristics, we classify it into three levels: if the index value is bigger than 0.6, it indicates that this crop is fit to expand the scale; if the index value is in 0.3–0.6, it indicates that this crop is relatively fit to expand the scale; if the index value is smaller than 0.3, it indicates that this crop is not fit to expand the scale.

The results show that the normalized explicit dominance of rice, sugarcane, mulberry, Sanhua plum and Jiuxian peach in Wengyuan County is 0.23, 0.94, 0.33, 0.22 and 0.46, respectively; in Wengyuan County, the sugarcane is fit to expand the scale, the mulberry and Jiuxian peach are relatively fit to expand the scale, and the rice and Sanhua plum are not fit to expand the scale.

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