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Characteristics and Advantages of Regional Grain Production in Guangxi Zhuang Autonomous Region of China

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Abstract According to the latest *Land Use Planning of Guangxi Zhuang Autonomous Region*, Guangxi is divided into five regions, which are eastern Guangxi, western Guangxi, southern Guangxi, northern Guangxi, and central Guangxi. Regional variation characteristics of grain production are introduced from two aspects of the decline of grain sowing area and the increase of grain output. According to the data in *Guangxi Statistical Yearbook*, comparative advantages of regional grain production in Guangxi Zhuang Autonomous Region are analyzed by the method of Comprehensive Comparative Dominance Index. Result shows that eastern Guangxi and northern Guangxi have the maximum comprehensive dominance indices with the minimum increasing amount of dominance indices. Their advantages in grain production are gradually diminished; and the grain production center is moving to central Guangxi and southern Guangxi. In order to solve the problems in grain production, Guangxi should make full use of the comparative advantage in agricultural production, carry out structural adjustment of agricultural production, and try to realize the rational distribution and specialization of agricultural production.

Key words Grain production, Comparative advantage, Dominance index, Guangxi Zhuang Autonomous Region of China

Analysis of comparative advantage of regional grain is an important means to promote the grain safety supply and to enhance the efficiency of grain production. Comparative advantage of regional grain usually uses the analysis method of regional grain dominance index. Based on the calculation of grain dominance index, economic driving factors are analyzed in order to better grasp the regional variation characteristics of grain production, to effectively make public policies for grain security strategy, and to realize the rational distribution and specialized production of agricultural production^[1]. Grain production plays an important role in the development of Guangxi Zhuang Autonomous Region of China. And the great difference between regional grain sowing area and yield has become a major bottleneck for the grain production and development of Guangxi. Therefore, correctly understanding the regional variation characteristics of grain production at present and giving full play to the comparative advantage in agricultural production are of great significance to guiding the structure adjustment of regional agricultural production, to promoting the grain safety supply, to enhancing the efficiency of grain production, and to realizing the coordinated development of agricultural production.

1 Regional division of Guangxi Zhuang Autonomous Region of China

Regional economy is a production complex generated by

the interaction of internal factors and external conditions of natural economic development in a certain region^[2]. Its development is restricted by the natural condition, socio-economic condition, technology policy, and other factors. According to the latest *Land Use Planning of Guangxi Zhuang Autonomous Region*, Guangxi is divided into five regions, which are eastern Guangxi, western Guangxi, southern Guangxi, northern Guangxi, and central Guangxi.

1.1 Eastern Guangxi It includes the areas of Yulin City, Guigang City and Wuzhou City with the total land area of 3 600.08 thousand hectares, accounting for 15.15% of the total land area of Guangxi Zhuang Autonomous Region. Among them, cultivated land area is 706.56 thousand hectares, accounting for 15.95% of the total cultivated land area. In the year 2008, total population is 14 570 thousand, accounting for 25.72% of the total population in Guangxi. Eastern Guangxi is close to Guangdong Province, with varied landforms and a large area of hills and plateaus. It has the typical characteristics of subtropical monsoon climate, such as sufficient light and heat, abundant rainfall, and long frost-free period, which together create a favorable climate condition for the development of regional agriculture. Thus, eastern Guangxi has relatively developed agricultural bases and an early start of agricultural industrialization management. Typhoons and rainstorms are the main agricultural disasters in this area.

1.2 Western Guangxi It includes the areas Baise City, Hechi City and Chongzuo City with the total land area of 8 701.00 thousand hectares, accounting for 36.62% of the total land area of Guangxi Zhuang Autonomous Region. Among them, cultivated land area is 1 345.86 thousand hectares, accounting for 30.38% of the total cultivated land area. In the year 2008, total

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population is 10 370 thousand, accounting for 4.75% of the total population in Guangxi. Western Guangxi is located at the edge of the Yunnan – Guizhou Plateau with a large area of Karst landform. It belongs to tropical monsoon climate and has high development value due to its nonferrous metals mineral resources, hydropower resources, Karst landscape, agricultural resources in mountainous area, and tourist resources of minority national features. The unique natural and geographical environment leads to the scale advantage of agricultural production. The major obstacles for the development of agriculture in this area are the fragile ecology, the large poverty-stricken area, many mountains and few lands, the backward science and technology.

1.3 Southern Guangxi (the Beibu Gulf Area) It includes the areas of Nanning City, Beihai City, Qinzhou City, and Fangchenggang City, with the total land area of 4 319.00 thousand hectares, accounting for 18.18% of the total land area of Guangxi Zhuang Autonomous Region. Among them, cultivated land area is 1 121.10 thousand hectares, accounting for 25.31% of the total cultivated land area. In the year 2008, total population is 12 990 thousand, accounting for 13.70% of the total population in Guangxi. Southern Guangxi is close to the Beibu Gulf Area, with its back against the southwest, facing Southeast Asia and connecting Vietnam in the southwest. Southern Guangxi is the only area that is both coastal and frontier in western China. It has the landscape of mainly hills, plains and plateaus, belongs to the transition zone from south subtropics to tropics, and is one of the areas in China having most abundant water and heat resources. Southern Guangxi provides a favorable environment for the development of agriculture, and becomes one of the most important agricultural production areas in Guangxi Zhuang Autonomous Region.

1.4 Northern Guangxi It includes the areas of Guilin City and Hezhou City with the total land area of 3 941.98 thousand hectares, accounting for 16.60% of the total land area of Guangxi Zhuang Autonomous Region. Among them, cultivated land area is 492.90 thousand hectares, accounting for 11.11% of the total cultivated land area. In the year 2008, total population is 280 310 thousand, accounting for 12.23% of the total population in Guangxi. Northern Guangxi connects Guangdong Province in the east and Hunan Province in the north, belonging to the agroforestry zone of Nanling Mountains. It is at the transition zone from central China climate to southern China climate. The complex landform and the imbalanced spatial and temporal distribution of rainfall in Northern Guangxi have restricted the development of agricultural economy.

1.5 Central Guangxi It includes the areas of Liuzhou City and Laibin City with the total land area of 3 197.84 thousand hectares, accounting for 13.45% of the total land area of Guangxi Zhuang Autonomous Region. Among them, cultivated land area is 764.01 thousand hectares, accounting for 17.25% of the total cultivated land area. In the year 2008, total population is 6 180 thousand, accounting for 7.23% of the total population in Guangxi. Central Guangxi is located in the hinterland of Guangxi with mainly four types of landforms, which are the

middle-low mountain landform type in Rongjiang River basin, the middle-low mountain landform type in Dayao Mountain, the karst hilly and plain landform type in the downstream of Hongshui River, and the low mountain and hilly landform type in the Liujiang River basin. Central Guangxi belongs to the transition zone from mid-subtropical zone to south subtropical zone with significant subtropical monsoon climate and imbalanced spatial and temporal distribution of rainfall. Drought, flood and low-temperature damage are the main factors restricting the development of agriculture in central Guangxi.

2 Regional variation characteristics of grain production

2.1 Declining trend of grain sowing area In recent years, grain unit yield maintains at a steady level in Guangxi Zhuang Autonomous Region, showing an upward trend in most of the areas. Under this situation, grain sowing area has become a dominant factor affecting the grain production. After the reform in the grain market, sowing area of grain crop begins to decline significantly in the whole region especially after the year 2005. In the year 2006, grain sowing area is only 3 133.2 thousand hectares. And in the years 2007 and 2008, the area increases a little to an average of 3 307.15 thousand hectares, which is 420.54 thousand hectares less than that in the year 2003. The reduction area is 12.8% of the overall grain sowing area in the year 2003.

In the years 2003 – 2008, grain sowing areas in the five regions all show a decreasing trend, except the southern Guangxi. Fig. 1 shows that grain sowing area in southern Guangxi increases by 21 040 hectares. Grain sowing area shows relatively weak fluctuation in both eastern Guangxi and southern Guangxi, reduced by 25 450 and 17 940 hectares and a decrease of 3.40% and 2.32%, respectively. Grain sowing area in northern Guizhou reduces by 58 730 hectares, a decrease of 11.09%. Western Guangxi and central Guangxi show a substantial decline of 224 280 and 94 143 hectares, a decrease of 25.64% and 22.52%, respectively. As a whole, grain sowing area in Guangxi shows a downtrend in the recent five years. The absolute decreasing amount of grain sowing area is related to the role of economic driver and the natural endowment of cultivated land resources. At the same time, the varied proportion also reflects the farmers' recognition degree to grain production.

2.2 Upward trend in grain production Grain production refers to the output of the entire society, including all the grain output produced by the collective, the state-owned economy, and the peasant household, as well as the output of the farm established by industrial and mining enterprises and other units^[3]. Proportion of Guangxi grain production in the whole China remains relatively stable, maintaining at the value of 3.14% – 3.61%. Planting area of rice in Guangxi takes the third place in China, greatly affecting the rice production of China.

According to the five regions in Guangxi Zhuang Autonomous Region, total grain output in southern Guangxi in the year 2008 slightly increases by 43.6 thousand tons compared with that in the year 2003, an increase of 1.23% (Table 2). Among

them, total output of grain in Nanning City increases by 264.7 thousand tons, an increase of 15.10%. Total outputs of grain in both central Guangxi and western Guangxi decline significantly by 222.9 thousand and 259.6 thousand tons, a decrease

of 13.06% and 9.43%, respectively. Total outputs of grain in both northern Guangxi and eastern Guangxi decline slightly by 281.8 thousand and 120.0 thousand tons, a decrease of 6.74% and 4.54%, respectively.

Table 1 Changing characteristics of grain sowing areas in different regions of Guangxi Zhuang Autonomous Region in the years 2003 and 2008 hm²

Region	Administrative region at city level	Grain sowing area in 2003	Grain sowing area in 2008	Fluctuation
Eastern Guangxi	Yulin City	326 050	314 790	-11 260
	Guigang City	264 020	257 000	-7 020
	Wuzhou City	158 070	150 900	-7 170
Western Guangxi	Baise City	361 040	268 170	-92 870
	Hechi City	334 890	271 200	-63 690
	Chongzuo City	178 720	111 000	-67 720
Southern Guangxi (the Beibu Gulf Area)	Nanning City	406 370	427 410	21 040
	Beihai City	92 740	78 190	-14 550
	Qinzhou City	211 620	205 590	-6 030
	Fangcheng City	62 430	44 030	-18 400
Northern Guangxi	Guilin City	377 690	360 790	-16 900
	Hezhou City	151 670	109 840	-41 830
Central Guangxi	Liuzhou City	181 990	1 593 00	-22 690
	Laibin City	235 970	164 520	-71 450
Guangxi	Total	3 343 270	2 922 730	-420 540

Note: Data come from the *Guangxi Statistical Yearbook*.

Table 2 Proportion change of grain production areas in Guangxi Zhuang Autonomous Region in the years 2003 and 2008 10⁴ t

Region	Administrative region at city level	Grain yield		Fluctuation
		2003	2008	
Eastern Guangxi	Yulin City	196.89	174.77	-22.12
	Guigang City	133.04	135.90	2.86
	Wuzhou City	88.19	79.27	-8.92
Western Guangxi	Baise City	107.45	105.58	-1.87
	Hechi City	106.78	102.80	-3.98
	Chongzuo City	63.81	43.70	-20.11
Southern Guangxi (the Beibu Gulf Area)	Nanning City	175.34	201.81	26.47
	Beihai City	42.36	35.95	-6.41
	Qinzhou City	111.33	102.59	-8.74
	Fangcheng City	24.37	17.41	-6.96
Northern Guangxi	Guilin City	189.21	185.19	-4.02
	Hezhou City	75.30	67.32	-7.98
Central Guangxi	Liuzhou City	79.89	76.60	-3.29
	Laibin City	90.83	71.83	-19.00
Guangxi	Total	1 484.79	1 400.71	-84.08

Note: Data come from the *Guangxi Statistical Yearbook*.

3 Comparative advantage analysis of grain production area in Guangxi

Research on the comparative advantage analysis of crop planting can be traced back to the period of David Ricardo. He points out that any country or region has its own relatively favorable production conditions, and can carry out specialized and large-scale production for certain crops^[4]. In this research, comparative advantage theory is applied in the grain production area of Guangxi. Comprehensive comparative dominance index of regional grain production is obtained through the analysis on the regional variation characteristics of grain production area. Then, changing trend in comparative advantage is analyzed in order to effectively adjust the production direction for grain planting areas in Guangxi, and to lay the foundation for the structural adjustment of agricultural production in Guangxi.

3.1 Data source and research method

3.1.1 Data source. Data in the years 2003 and 2008 after the adjustment of administrative division are compared. And the data are mainly from the *Guangxi Statistical Yearbook*.

3.1.2 Research method. The research mainly uses the method of Comprehensive Comparative Dominance Index, which is commonly used in China, to measure the variation of the comparative advantages in grain production in different cities. Comprehensive Comparative Dominance Index is composed by two parts.

Scale dominance index: $GAI = (S_{gi}/S_{ti}) / (S_{gt}/S_{tt})$, where GAI is the scale dominance index of a certain region, S_{gi} is the grain sowing area of a certain region, S_{ti} is the total crop sowing area of a certain region, S_{gt} is the total grain sowing area of Guangxi, and S_{tt} is the total crop sowing area of Guangxi.

Efficiency dominance index: $XAI = (P_{gi}/S_{gi}) / (P_{gt}/S_{gt})$, where XAI is the efficiency dominance index of a certain region, P_{gi} is the grain output of a certain region, and P_{gt} is the total grain output of China.

Comprehensive Comparative Dominance Index:

$$R = \sqrt{GAI \times XAI} - 1.$$

$R \geq 0$ indicates that the grain crops in this region have comprehensive comparative advantage. The greater value indicates more significant planting advantages. $R < 0$ shows that

the grain crops in this region have relatively weak comprehensive comparative advantage. The smaller value indicates greater disadvantage.

3.2 Security level and classification Security level is divided into six grades, the order of 1–6 grade means that the security level is gradually increased; warning light changes from deep to shallow; alerts degree grows gradually weaker. And black means food crisis. Meanings of all security statuses are as follows. Firstly, comparative advantage indicates that this region has very high grain security level, and its grain production capacity has dominance in Guangxi. Black warning light should be used as $-0.92 > R \geq -0.94$. Secondly, sub advantage; this region has relatively high grain security level; its grain production capacity is a little inferior to the advantage. Black grey warning light should be used as $-0.91 > R \geq -0.92$. Thirdly, mild disadvantage indicates that this region has normal grain security level and general grain production capacity. Grey warning light should be used as $-0.90 > R \geq -0.91$. Fourthly, moderate disadvantage indicates that this region has relatively low grain security level and weak grain production capacity. Medium grey warning light should be used as $-0.89 > R \geq -0.90$. Fifthly, great disadvantage indicates that this region has low grain security level and poor grain production capacity. Light grey warning light should be used as $-0.88 > R \geq -0.89$. Sixthly, food crisis means that this region has serious low grain security level and extremely poor grain production capacity. White warning light should be used as $R \geq -0.88$.

3.3 Analysis of the calculation result Table 3–4 show

Table 3 Scale dominance index of grain production area in Guangxi

Region	Administrative region at city level	2003	2008	Region	Administrative region at city level	2003	2008
Eastern Guangxi	Yulin City	-0.87	-0.88	Western Guangxi	Baise City	-0.91	-0.91
	Guigang City	-0.89	-0.88		Hechi City	-0.91	-0.90
	Wuzhou City	-0.88	-0.89		Chongzuo City	-0.92	-0.94
Southern Guangxi (the Beibu Gulf Area)	Nanning City	-0.91	-0.91	Northern Guangxi	Guilin City	-0.90	-0.89
	Beihai City	-0.91	-0.90		Hezhou City	-0.90	-0.88
	Qinzhou City	-0.89	-0.89	Central Guangxi	Liuzhou City	-0.91	-0.91
	Fangcheng City	-0.91	-0.92		Laibin City	-0.91	-0.90

Table 4 Distribution of comprehensive comparative advantages of Guangxi in the years 2003 and 2008

Security level	R value	Advantage status	Warning light	Distribution quantity	
				2003	2008
1	-0.94 – -0.92	Comparative advantage	Dark	0	1
2	-0.92 – -0.91	Sub advantage	Black grey	1	1
3	-0.91 – -0.90	Mild disadvantage	Grey	7	3
4	-0.90 – -0.89	Moderate disadvantage	Medium grey	2	3
5	-0.89 – -0.88	Great disadvantage	Light grey	2	3
6	-0.88 – -0.87	Food crisis	White	2	3
Total				14	14

4 Conclusion and discussion

During the years 2003–2008, proportion of grain production is gradually reduced in most areas of Guangxi Zhuang Autonomous Region, China. There is inadequate coordination between urbanization and agricultural development; and the agricultural input is relatively small. According to the Comprehensive Comparative Dominance Index of grain, eastern Guangxi and northern Guangxi have the maximum value, which become

that there are in all 6 cities in Guangxi with security level greater than grade 4 in the year 2003, accounting for 42.86%. Among the five regions, security levels of comprehensive comparative advantages in eastern Guangxi and northern Guangxi are both higher than grade 4. Except Qinzhou City, cities in southern Guangxi are classified into grade 3. However, both central Guangxi and western Guangxi belong to grade 2, which is at great disadvantage status. In the year 2003, grain production advantage regions are mainly located in the eastern Guangxi and northern Guangxi, where light, temperature, water, heat, and land development conditions are relatively good. Fig. 1A illustrates that the comparative advantage of grain is greatly affected by the natural conditions. In the year 2008, there are slight fluctuations in grain production areas. A total of 9 cities are divided into grades 4–6, accounting for 64.29% of the overall cities in Guangxi. Among the five regions, eastern Guangxi and northern Guangxi are still the optimal food production areas, with security level greater than grade 2. Among them, comparative dominance index of grain production has increased by 0.01 on average in each city of northern Guangxi. Except Fangcheng City, cities in central and southern Guangxi are all above grade 3. Comparative dominance index of grain production decreases significantly in Chongzuo City of western Guangxi, becoming the only city under food crisis (Fig. 1B). Therefore, grain production advantages of eastern Guangxi and northern Guangxi are gradually expanding into central and southern Guangxi (Fig. 1C).

the areas with the highest grain production advantages in Guangxi. At the same time, central Guangxi and southern Guangxi have the most significant increase in dominance index. This indicates that grain production advantages of eastern Guangxi and northern Guangxi are gradually diminished and are transferred into central Guangxi and southern Guangxi.

In a word, it is an irresistible general trend that grain production (To page 9)

business phenomenon. It is not good for improvement of production efficiency and development of industrialization and urbanization, and then, the improvement of labor productivity and economic profit will be restrained. In the development of contract farming, in order to improve discourse right of peasant households, it is necessary to scale of operation and production of peasant households. And to realize moderate scale operation, it is necessary to further improve land circulation system and make full use of limited land resources. On the one hand, further improve land property right system in countryside, give peasant households the land contract for the managerial right. Never intervene peasant households in legal, volunteering and compensated land circulation of contracted land in contract period. Make peasants as the real main part of profit in land circulation. On the other hand, build sound market of land circulation, set up trading place for land management right, provide trading platform and system guarantee for standardization and institutionalization of land circulation.

4.3 Building honest information systems Take follow up investigation realistic record of honesty conditions of leading enterprises and peasant households. Announce honesty index regularly, form an open information platform of honesty. Building personal honesty file can set out from quality record of agricultural products. Spread the record system of the whole process of production of agricultural products, so as to review the responsibility of the agricultural products in the market to the producers. Make records and archives administration of the honesty conditions of producers. In addition, strive to develop service network of agricultural information, guide peasant households using existing communications media such as broadcast, TV, internet to explore and grasp market informa-

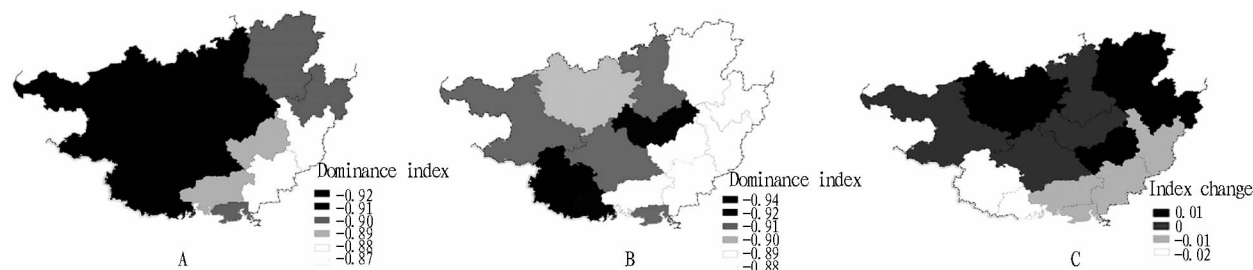
tion, so as to change its weakness position of information.

4.4 Constructing social honesty system Honesty is one of the social capitals, and also the lubricant of the operation of contract farming. It can save transaction cost by a large margin. When construct social honesty system, firstly, it is needed to have a honesty information database, in order to make sure of rapid transmitting of dishonest information of enterprises or peasant households. On the basis of information database, construct credit rating system. Not only determine line of credit of enterprises as a peasant households by this, but also use credit rating as the standard to determine enjoyed right of economic bodies in all aspects of production, management and recreational activities. Truly make honesty become the necessary personal moral for living in the society. Secondly, it is needed to have a believable punishment mechanism. The contractors can not get no punishment of dishonesty because of lacking of compensation capability or other reasons. At last, moral restraint is a low cost supervision means, we can convert social norm into value orientation of people. Only the honesty enjoys popular support, can thee relevant system of supervising dishonest behavior operate with high efficiency.

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Note: A and B show the index change in the years 2003 and 2008; while C indicates the change of comprehensive index.

Fig.1 Changes in the comprehensive dominance index of grain production in Guangxi in recent five years

in eastern Guangxi and northern Guangxi will be weakened and the advantages will be transferred into central Guangxi and southern Guangxi. This is also an inevitable result of the market reform. Weakening the grain production will help to optimize the agricultural structure, to promote the rational allocation of labor, and to increase the farmers' income level in central and southern Guangxi. Therefore, we should make full use of the comparative advantage in agricultural production, guide the structure adjustment of agricultural production in different areas according to the law of comparative advantage, and achieve the rational distribution and specialized production of agricultural production.

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