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Research Article

Examining the Development Level of Green Agriculture and Regional Differences in China in the Context of Carbon Peak and Carbon Neutrality

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Abstract

Green agriculture played an active part in green development, it is a necessary way for China to achieve Carbon Peak and Carbon Neutrality. Based on the background of Carbon Peak and Carbon Neutrality and the requirements of sustainable development, the study constructed the evaluation index system of China's green agriculture development level and empirically analyzed the development level of China's green agriculture along with regional development gaps based on the empirical data from 2014 to 2021. The research found that China's green agriculture development level from 2014 to 2021 has been rising each year. Yet, there were certain differences in the development level of green agriculture in 31 provinces (direct-administered municipalities and autonomous regions), and the green agriculture Development in four major regions was not balanced, showing the regional distribution characterized by highest in the east, second in the west, third in the center and lowest in the northeast region, and the gap between the East and Northeast was large, which seriously restricted the further improvement of China's green agriculture development level. To facilitate the realization of Carbon Peak and Carbon Neutrality, China's green agriculture development should strengthen the technical support to form a resource-saving and environment-friendly modernized agricultural development system. At the same time, multiple measures should be taken to narrow the development gap between different regions.

Keywords

Green Agriculture, Development Levels, Regional Differences, Carbon Peak, Carbon Neutrality

1. Introduction

China announced its Carbon Peak and Carbon Neutrality vision in 2020 to promote global sustainable development. The green development model is important for realizing Carbon Peak and Carbon Neutrality. Green development was aimed at achieving sustainable development. It emphasized the laws of economic and social development. In terms of the ecological and environmental capacity and the carrying capacity of resources, the company achieved a reintegration of all kinds of resource factors and implemented the *Green* concept throughout the industrial process [1]. Green agriculture played an active part in green development. It is a foundation of China's sustainable economic development, a proper justification for advancing the construction of ecological civilization and the strategy of rural revitalization, an urgent

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need to accelerate the development of agricultural modernization, and a necessary way for China to achieve Carbon Peak and Carbon Neutrality [2].

China has always paid great attention to the development of green agriculture. In 2017, the *No. 1 Central Document* emphasized that *Green* should be highlighted in agricultural modernization and that multiple measures should be taken to boost the development of green agriculture comprehensively. In the same year, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the *Opinions on Promoting the Green Development of Agriculture through Innovative Systems and Mechanisms*, which provided an overall deployment of green agriculture. In 2021, the Ministry of Agriculture and Rural Affairs and six other Ministries and Commissions jointly issued the *14th Five-Year Plan for the Green Development of National Agriculture*. This was the first special plan for the green development of agriculture in China, which required the implementation of the central government's major strategic decision on Carbon Peak and Carbon Neutrality by planning the green development of agriculture scientifically for accelerating the comprehensive transformation and upgrading of green agriculture [3]. To facilitate the realization of the goal of Carbon Peak and Carbon Neutrality, the whole country actively engaged in the development of green agriculture, but there were still some areas where the phenomenon of green agriculture was not adapted to the local environment [4], for instance, the crude mode of production still existed. The pollution of the agricultural surface was still severe, and so on. In fact, after so many years of development, what is the overall development level of green agriculture in China? Is there a gap between different regions? These questions are worthy of some deeper explorations.

In recent years, the development of green agriculture has received extensive attention from scholars domestically and internationally. Among them, the evaluation of the development level of green agriculture is one of the research focuses. Most foreign scholars associated green agriculture with sustainable agriculture development and eco-agriculture, and their studies on the development level of green agriculture focused on the study of environmental evaluation indexes and evaluation methods [5-7]. Domestic scholars studied green agriculture as an independent, comprehensive concept and constructed a comprehensive evaluation system [8]. With the deepening of the concept of green development, scholars have also included resource-saving, low-carbon economy, high-quality development, and other aspects in the evaluation index system of the green agriculture development level. In the selection of evaluation methods, scholars mainly adopted the entropy method [9], analytic hierarchy process [10], gray relational analysis [11], data envelopment analysis [12], and other methods to analyze. Even though both domestic and international scholars have studied the development level of green agriculture, a unified standard has not yet been formed, mainly because different scholars have conducted research based on different perspectives and scenarios. Given China's current development situation and needs, this paper aimed to construct an evaluation index system for China's green agriculture development level based on the background of Carbon Peak and Carbon Neutrality. Combined with the requirements of sustainable development, it empirically analyzed China's green agriculture development level and regional development gaps based on the empirical data from 2014 to 2021 to better clarify the situation of China's green agriculture development and propose more targeted countermeasures and suggestions.

2. The History of Green Agriculture Development in China

In the 1990s, the concept of green agriculture was explicitly proposed in China, and in 2003 it was officially introduced. Subsequently, China has practically explored green agriculture and made great progress. According to the depth and width of green agriculture advancement in China, green agriculture development could be divided into three stages.

2.1. Green Agriculture Exploration and Development Stage (Before 2003)

With the increasingly serious problems of soil and water pollution brought about by the development of petroleum-based agriculture, western countries have proposed the development of eco-agriculture, sustainable agriculture, and so on. Influenced by Western developed countries, China also gradually realized the importance of developing eco-agriculture, and from the 1980s, China began to conduct eco-agriculture pilot projects in some counties and districts. At the same time, China introduced the development of green food and formally implemented the green food engineering program. To facilitate the implementation of the green food project, China has set up a green food development center and established many agricultural facilities that are conducive to improving the quality and safety of green food, such as the establishment of county-level green food production bases and green agricultural products have become one of the government's key concerns, resulting in the rise of a green agriculture development model.

2.2. The Steady Development Stage of Green Agriculture (2003-2012)

In 2003, the China Green Food Association formally introduced the concept of *green agriculture* for the first time at the *International Seminar on Green Food and Organic Agriculture Market Channel Construction in the Asia-Pacific Region* organized by the United Nations Asia-Pacific Council in

Changyuan, Henan Province, China. Since the concept of *green agriculture* was formally proposed, China has actively strengthened exchanges and cooperation with foreign countries and further accelerated the development of green agriculture. For example, it has organized green food production enterprises to participate in organic food fairs held in developed countries so that more green agricultural enterprises can "go abroad." Another example is Zhejiang, which took the lead in making green agriculture a key development direction for modern agriculture in 2003, launching the construction of green and ecological agricultural demonstration counties, standard farmland, and modern agricultural demonstration zones, implementing the *Build 1,000 Demonstration Villages, Renovate 10,000 Villages* project. It implemented the development of ecological recycling agriculture in 2010.

2.3. The Comprehensively Deepening Stage of Green Agriculture (2013 - Present)

Since the 18th Party Congress, with the introduction of the green development concept, China's green agriculture development has entered a rapid development stage. China's agricultural green development index has risen year after year since 2012, and some of the indexes of the pioneer areas have exceeded 85% [13]. To better promote the development of green agriculture and accelerate the transformation and upgrading of agriculture, China has formulated a series of policy initiatives, such as the establishment of the National Research Institute for Green Agricultural Development in 2018, which created a new model for sustainable agricultural development. The supply capacity of green agricultural food has been continuously improved, the environmental protection of the agricultural production area was evident, and the green agricultural industrial structure has been initially formed [14]. In 2020, the national area of organic fertilizer application exceeded 550 million mu/times, an increase of about 50% compared with 2015, and the coverage rate of major crop pests and diseases covered by green prevention and control was over 41.5%, an increase of 18.5 percentage points compared with 2015 [15]. With the continuous deepening of agricultural green development, recycling development, and low-carbon development, China has continuously strengthened the modernization of the green agricultural industry chain. The automation and science and technology levels of green agriculture have been gradually improved (see Figure 1). In 2022, the contribution rate of agricultural scientific and technological progress reached 62.4%. The comprehensive mechanization rate of national crop plowing, planting, and harvesting reached 73.11%, a 15.91% increase compared with 2012.

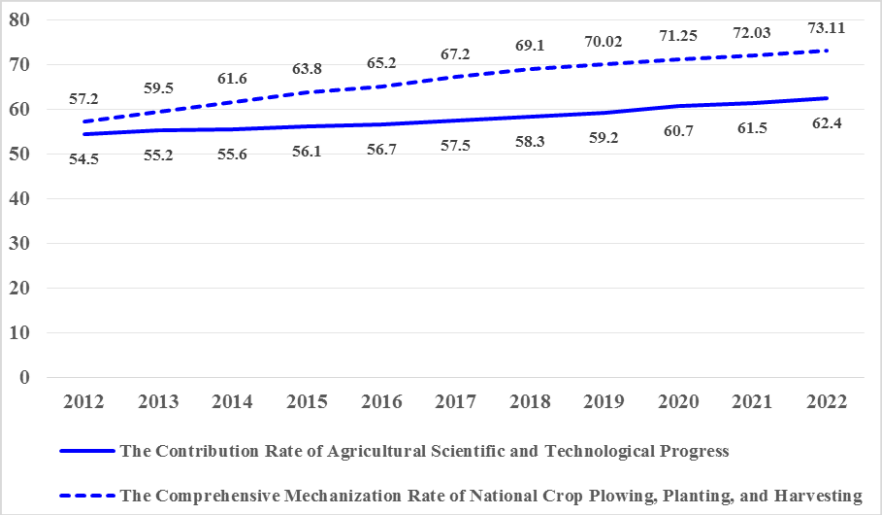

Figure 1. *China's Agricultural Science and Technology Development Level, 2012-2022.*

3. Indicator System Construction, Research Methods, and Data Sources

3.1. The Construction of the Green Agriculture Development Level Index System

Green agriculture indicated that agriculture was to ensure the safety of agricultural products, ecological safety, and resource safety by using the standardization of agricultural products, advanced science and technology, advanced industrial equipment, and advanced management concepts [16]. In essence, green agriculture represented a high-quality model of sustainable agricultural development, emphasizing agricultural sustainability, environment-friendliness, resource effectiveness, and food quality. In the context of Carbon Peak and Carbon Neutrality, the important characteristics of green agriculture development were emission reduction and

carbon reduction, i.e., resource-saving and environmental optimization. Based on the principles of science, systematicity, representativeness and accessibility in the selection of indicators, this paper selected six indicators to comprehensively evaluate the development level of China's green agriculture, including the utilization rate of agricultural land, water resources, agricultural machinery, fertilizer application rate, pesticide utilization rate, and agricultural film utilization rate, by referencing the research results of Qi et al.[17] and Lv et al. [13] (see Table 1).

Table 1. *The Evaluation Indicators for China's Green Agriculture Development Level.*

Indicator	Sign	Indicator Explanation	Indicator Direction
Agricultural Land Utilization Rate	X1	Crop sown area per 10,000 yuan of agricultural output (ha/million yuan)	Negative
Water Resources Utilization Rate	X2	The ratio of the effective irrigated area to crop sown area (%)	Positive
Agricultural Machinery Utilization Rate	X3	Amount of agricultural machinery invested per 10,000 Yuan of agricultural output value (kW/million Yuan)	Negative
Fertilizer Application Rate	X4	Amount of fertilizer purity rate consumed per 10,000 Yuan of agricultural output value (t/million Yuan)	Negative
Pesticide Utilization Rate	X5	Pesticides consumed per 10,000 Yuan of agricultural output value (tons/million yuan)	Negative
Agricultural Film Utilization Rate	X6	Agricultural film consumed per 10,000 Yuan of agricultural output value (tons/million yuan)	Negative

3.2. Research Method

The entropy method was used to evaluate the development level of green agriculture in China. This method was an objective method of assigning weights based on the information provided by all the selected evaluation indicators and determining the weights of the indicators based on the relative variation degree of the indicators (the degree of dispersion) on the overall impact of the system [18]. Therefore, in the specific analysis, the degree of variation of entropy value could be used to calculate the weight of each indicator and then weigh all the indicators, which resulted in a more objective and comprehensive evaluation. It mainly included the following steps:

First, data normalization. When the higher value of the indicator indicated that it was more beneficial to the development of green agriculture, the positive indicator calculation method was used, $X_{ij}^{'} = \left(X_{ij} - \min\left\{X_j\right\}\right) / \left(\max\left\{X_j\right\} - \min\left\{X_j\right\}\right)$; when the lower value of the indicator indicated that it was more beneficial to the development of green agriculture, the negative indicator calculation method was used to deal with it, $X_{ij}^{'} = \left(\max\left\{X_j\right\} - X_{ij}\right) / \left(\max\left\{X_j\right\} - \min\left\{X_j\right\}\right)$.

Second, the weight of the indicator value j in the year i was calculated:

$$Y_{ij} = X_{ij}^{'} / \sum_{i=1}^{m} X_{ij}^{'} \tag{1}$$

Third, the calculation of indicator information entropy:

$$e_j = -k\sum_{i=1}^{m}\left(Y_{ij} \times \ln Y_{ij}\right), \text{ let } \quad k = \frac{1}{\ln m}, \quad 0 \le e_j \le 1. \tag{2}$$

Fourth, the calculation of information entropy redundancy:

$$d_j = 1 - e_j \tag{3}$$

Fifth, indicator weight:

$$w_j = d_j / \sum_{j=1}^{n} d_j \tag{4}$$

Sixth, single indicator evaluation score:

$$S_{ij} = w_j \times X_{ij}^{'} \tag{5}$$

Seventh, the composite score of the i th year:

$$S_i = \sum_{j}^{n} S_{ij} \quad (6)$$

Where X_{ij} represented the value of the j th evaluation indicator in the i th year. $\min\{X_j\}$ and $\max\{X_j\}$ were the minimum and maximum values of the j th evaluation indicator in all the years, respectively, where m was the number of years of evaluation and n was the number of indicators.

The entropy method was used to calculate the weights of the six indicators: agricultural land utilization rate, water resource utilization rate, agricultural machinery utilization rate, fertilizer application rate, pesticide utilization rate, and agricultural film utilization rate for each year (see Table 2).

Table 2. *The Weights of Indicators for Measuring Green Agriculture Development Levels by Year.*

Year	X1	X2	X3	X4	X5	X6
2014	0.2581	0.3411	0.0624	0.2125	0.0673	0.0587
2015	0.2171	0.3892	0.0668	0.1920	0.0718	0.0630
2016	0.1967	0.4115	0.0668	0.1645	0.0903	0.0702
2017	0.1723	0.4006	0.0733	0.1291	0.1520	0.0727
2018	0.1752	0.3834	0.0688	0.1166	0.1842	0.0719
2019	0.1572	0.4107	0.0688	0.1171	0.1649	0.0813
2020	0.1447	0.4064	0.0695	0.1354	0.1570	0.0869
2021	0.1620	0.3811	0.0688	0.1168	0.1960	0.0753

3.3. Data Sources

Given the study period and the data's completeness, this paper selected the data from 31 provinces (direct-administered municipalities and autonomous regions) of China from 2014 to 2021 for analysis. Due to the missing data from Taiwan, Hong Kong, and Macao, they were not included in the analysis of this paper for the time being. The main sources of data were selected from the *China Statistical Yearbook*, the *China Rural Statistical Yearbook*, and the website of the National Bureau of Statistics.

4. Evaluation Results and Analysis

4.1. The Measurement Results of China's Green Agriculture Development Level

Figure 2 showed China's green agriculture development index from 2014 to 2021. As can be seen from Figure 2, from 2014 to 2021, the level of China's green agriculture development has shown a year-on-year increase, indicating that China's agriculture has been accelerating its green transformation and that green agriculture has been steadily developing, which was closely related to China's in-depth implementation of the concept of green development. For example, in 2020, China announced the target vision of Carbon Peak and Carbon Neutrality, and the development of green agriculture in China has gradually entered the "fast lane". From the development of green agriculture in 31 provinces (direct-administered municipalities and autonomous regions) (see Table 3), from 2014 to 2021, the development level of green agriculture in seven provinces (direct-administered municipalities and autonomous regions), including Shanxi, Heilongjiang, Anhui, Jiangxi, Chongqing, Yunnan, and Gansu, showed a year-on-year trend of improvement, and the development level of green agriculture in the other provinces (direct-administered municipalities and autonomous regions), although fluctuating, was generally improving.

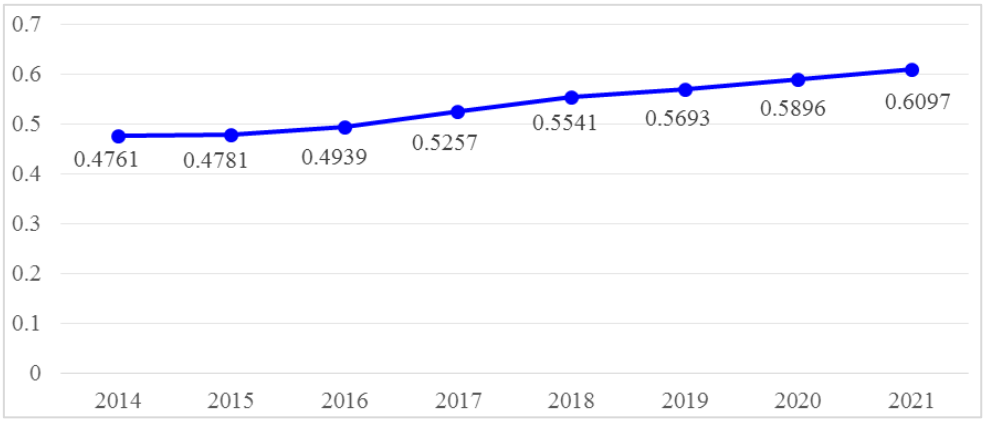

Figure 2. *China's Green Agriculture Development Index, 2014-2021.*

Data Source: The national green agriculture development index was obtained by calculating the average comprehensive value of the green agriculture development index of 31 provinces (direct-administered municipalities and autonomous regions)

Table 3. *Green Agriculture Development Index of 31 Provinces (Direct-Administered Municipalities and Autonomous Regions) in China, 2014-2021.*

Region	Provinces	2014	2015	2016	2017	2018	2019	2020	2021
East	Beijing	0.7655	0.7662	0.7961	0.8288	0.8754	0.9489	0.8943	0.8236
	Tianjin	0.6577	0.6694	0.6694	0.6856	0.7145	0.7343	0.7422	0.7359
	Hebei	0.4919	0.4810	0.4989	0.5304	0.5729	0.5848	0.6076	0.6044
	Shanghai	0.6129	0.6060	0.6323	0.6610	0.6770	0.6990	0.6729	0.6694
	Jiangsu	0.5765	0.5818	0.5912	0.6156	0.6316	0.6337	0.6448	0.6432
	Zhejiang	0.7083	0.7008	0.7168	0.7136	0.7232	0.7182	0.7302	0.7129
	Fujian	0.7131	0.6968	0.7118	0.7242	0.7390	0.7342	0.7456	0.6987
	Shandong	0.5176	0.5096	0.5161	0.5397	0.5619	0.5668	0.5817	0.6096
	Guangdong	0.5770	0.5609	0.5660	0.5738	0.6023	0.6040	0.6137	0.6183
	Hainan	0.5688	0.5478	0.5737	0.5806	0.6131	0.6184	0.6333	0.6782
Central	Shanxi	0.3042	0.3132	0.3515	0.3935	0.4218	0.4517	0.4974	0.5305
	Anhui	0.3488	0.3680	0.4321	0.4735	0.4914	0.5197	0.5462	0.5662
	Jiangxi	0.4071	0.4143	0.4316	0.4462	0.4724	0.5050	0.5321	0.5575
	Henan	0.3283	0.3262	0.3484	0.3965	0.4236	0.4470	0.4913	0.5273
	Hubei	0.4533	0.4531	0.4767	0.5029	0.5227	0.5358	0.5580	0.5903
	Hunan	0.4407	0.4366	0.4548	0.4732	0.4951	0.5295	0.5541	0.5595
West	Neimeng	0.3043	0.2896	0.2913	0.3340	0.3894	0.4020	0.4374	0.5156
	Guangxi	0.4542	0.4466	0.4496	0.4800	0.5194	0.5155	0.5334	0.5421
	Chongqing	0.3491	0.3613	0.3983	0.4333	0.4675	0.4748	0.5027	0.5302
	Sichuan	0.4850	0.4829	0.4912	0.5170	0.5419	0.5402	0.5653	0.5796
	Guizhou	0.3467	0.4115	0.4380	0.4821	0.5178	0.5149	0.5359	0.5759
	Yunnan	0.3596	0.3605	0.3839	0.4226	0.4619	0.4888	0.5255	0.5609
	Xizang	0.6981	0.7154	0.7005	0.7622	0.7633	0.7962	0.8230	0.8541

Region	Provinces	2014	2015	2016	2017	2018	2019	2020	2021
	Shaanxi	0.4214	0.4153	0.4351	0.4847	0.5150	0.5218	0.5440	0.5630
	Gansu	0.1939	0.2183	0.2512	0.3244	0.3686	0.4011	0.4316	0.4851
	Qinghai	0.5117	0.4904	0.5068	0.5429	0.5813	0.5883	0.6078	0.6242
	Ningxia	0.3401	0.3772	0.4137	0.4627	0.5108	0.5102	0.5497	0.5844
	Xinjiang	0.6661	0.6765	0.6345	0.6664	0.6726	0.6791	0.6927	0.8246
	Liaoning	0.5491	0.5256	0.5163	0.5392	0.5587	0.5599	0.5704	0.6017
Northeast	Jilin	0.2516	0.2498	0.2379	0.2580	0.3031	0.3410	0.4019	0.4195
	Heilongjiang	0.3557	0.3690	0.3961	0.4469	0.4680	0.4850	0.5107	0.5155

4.2. Analysis of Regional Differences in China's Green Agriculture Development

To further analyze the regional differences in the development of green agriculture in China, the country's 31 provinces (direct-administered municipalities and autonomous regions) were divided into four major regions, namely, eastern, central, western, and northeastern, as per the usual convention. As can be seen from Figure 3, from 2014 to 2021, the three major regions of central, western, and northeastern regions have the same trend of change in the level of green agriculture development, showing a trend of annual growth, while the level of green agriculture development in the eastern region is developing steadily in the midst of fluctuations. The index was significantly higher than the other three major regions, ranking the first of the four major regions, with the western region coming second. The northeastern region's green agriculture, except for 2014 and 2015, ranked at the bottom of the green agriculture development index. In short, the green agriculture development index of the four regions showed the regional distribution characterized by highest in the east, second in the west, third in the center and lowest in the northeast region. There were obvious gaps in the green agriculture development index of the four regions, especially the gap between the eastern and northeastern regions, indicating obvious regional differences in the level of China's green agriculture development.

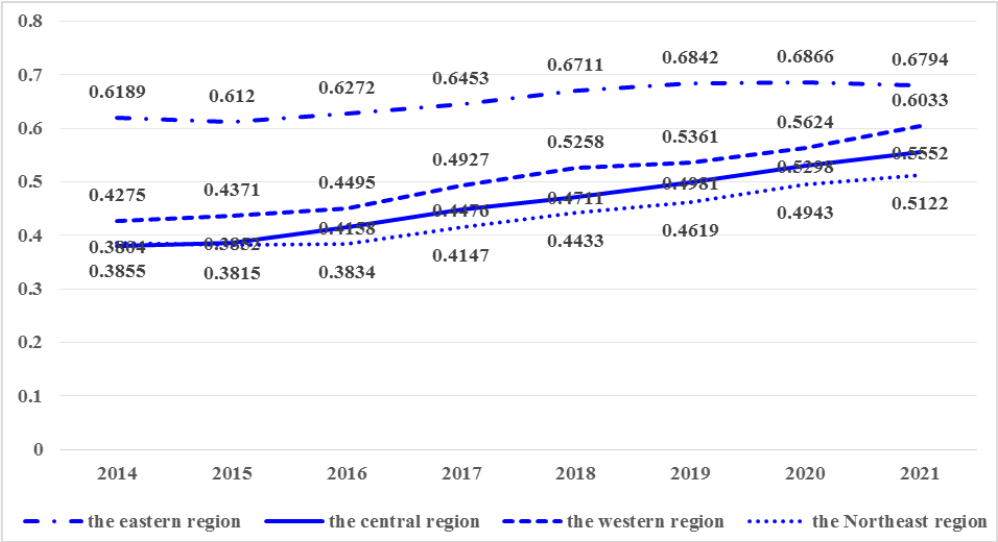

Figure 3. Green Agriculture Development Index for Four Major Regions in China, 2014-2021.

The eastern region was economically developed, focusing on industrial transformation and upgrading, and the development of green agriculture was more rapid. At the same time, the unique climatic conditions in the western region also created natural conditions for the development of green agriculture, with greater development potential. The level of green agriculture development in the central region was not high. Still, the level of development of the internal provinces

(direct-administered municipalities and autonomous regions) was more balanced, and it had not yet fully exploited the natural advantages of its flat terrain and abundant light, which led to the slower development of green agriculture. In recent years, the green agriculture development index in the Northeast region has been rising year by year, still, in the four regions ranked last. The three provinces within the Northeast region developed unevenly. Jilin's green agriculture development index was relatively low, with certain gaps between Liaoning and Heilongjiang. In addition to the impact of climatic conditions, the reason for this was mainly due to the single mode of agricultural production in Jilin. Its level of agricultural science and technology was not high, and the development of green agriculture was limited. As one of the important commodity grain production bases in China, the Northeast region should accelerate the application of advanced agricultural technology to ensure the sustainable utilization of black soil and facilitate the more rapid development of green agriculture.

Data source: The green agriculture development index for each region was obtained by calculating the average comprehensive value of the green agriculture development index for each province (direct-administered municipalities and autonomous regions) within each region.

At the level of provinces (direct-administered municipalities and autonomous regions), Beijing, Fujian, Zhejiang, Tianjin, and Shanghai in the eastern region and Xinjiang and Xizang in the western region ranked high in the green agriculture development index and were at the top in the country. From 2014 to 2021, Beijing's green agriculture development index was ahead of the other provinces (direct-administered municipalities and autonomous regions) and ranked first. It declined in 2021 but was still ranked at a high level. In recent years, Beijing has accelerated the development of green agriculture and built three national modern agricultural industrial zones in Miyun, Pinggu, and Tongzhou. Among them, the modern agriculture industrial zone in Tongzhou District has realized the green cycle development of agricultural production, with the water-saving irrigation rate of the zone reaching 100%, the comprehensive treatment rate of agricultural organic waste reaching 98.79%, the rate of the sampling inspection of the agricultural products quality and safety and the qualification rate of the pesticide residue inspection reaching 99%, and the number of the green and organic product certifications reaching 56, and the green certified output of vegetables reaching 93,800 tons [19]. Aiming at its own characteristics of rich and diverse agricultural resources, Fujian innovated agricultural science and technology systems and mechanisms to continuously increase scientific and technological research in key areas of agriculture and created many new varieties of agriculture, new technologies, new modes of integration of demonstration bases for green agricultural development to achieve greater results. Zhejiang's green agricultural development has been at the forefront of the country since as early as 2003 when it was initiated to develop efficient eco-agriculture. It has been a pilot province of modern eco-cycling agriculture, a pilot province of sustainable development of marine fisheries, a demonstration province of the green development of animal husbandry, and the first whole province to implement a pilot project to boost the green development of agriculture as a pilot construction zone. It integrated measures from technology, standards, policies, figures, and other aspects to make green the bottom color of Zhejiang agriculture's bottom color. In recent years, to promote the development of green agriculture, Xinjiang has introduced the *Xinjiang Uygur Autonomous Region Regulations on the Management of Agricultural Mulch Film*, *Opinions on Strengthening the Treatment of Waste Film Pollution in Agricultural Fields in the Autonomous Region,* and other initiatives. Recycling residual film, biodegradable film, and other ways to control the "white pollution" of agricultural fields at the source improved the ecological environment of agriculture in rural areas. Xizang was an important ecological security shield for China. To protect the fragile and sensitive ecology and fully utilize the pollution-free environment of the plateau, Xizang vigorously developed green agriculture by comprehensively upgrading the quality of arable land, advancing the emission reduction and carbon sequestration of agriculture, and optimizing the crop germplasm resources and other initiatives to meet the requirements of the goal of Reaching Carbon Peak and Carbon Neutrality for the sustainable development of agriculture. Although some provinces (direct-administered municipalities and autonomous regions) developed green agriculture at a high level, some provinces (direct-administered municipalities and autonomous regions) developed green agriculture at a low level, such as Gansu and Jilin, etc., and there were large gaps in the green agriculture development index between provinces. In 2021, Beijing's green agriculture development index was close to twice that of Jilin, indicating that the regional differences in the development of green agriculture in China remained large.

5. Conclusions and Implications

In the context of Carbon Peak and Carbon Neutrality, the important characteristics of green agriculture development are resource-saving and environmental optimization. This study selected six indicators, namely, agricultural land utilization rate, water resource utilization rate, agricultural machinery utilization rate, fertilizer application rate, pesticide utilization rate, and agricultural film utilization rate to comprehensively evaluate the development level of green agriculture in China and the differences in regional development by using historical empirical data. The study found that: first, the level of green agriculture development in China from 2014 to 2021 showed a yearly increase, in which Shanxi, Heilongjiang, Anhui, Jiangxi, Chongqing, Yunnan, Gansu and other provinces (direct-administered municipalities and autonomous regions), the green agriculture development levels also showed a yearly

increase trend, which made the overall level of China's green agriculture development relatively high. Second, China's four major regions of green agriculture development was unbalanced, showing the regional distribution characterized by highest in the east, second in the west, third in the center and lowest in the northeast region. The gap between the eastern and northeastern regions was large, which seriously constrained the further improvement of China's green agriculture development level. Thirdly, there were certain differences in the development level of green agriculture in 31 provinces (direct-administered municipalities and autonomous regions), among which Beijing, Fujian, Zhejiang, Tianjin, Shanghai, Xinjiang, Xizang and other provinces (direct-administered municipalities and autonomous regions) were ahead of other provinces in terms of the development index of green agriculture. From the above research conclusions, the following implications are learned:

On the one hand, the development of green agriculture in China should strengthen technological support and form a modernized agricultural development system that is resource-saving and environmentally friendly. Further research and development, application, and promotion of high-efficiency and low-pollution intelligent agricultural machinery and equipment will enhance the level of agricultural mechanization; technological research in key areas and core links of agriculture should be continuously propelled; the utilization efficiency of land and water resources should be improved; the research and development of high-efficiency, low-harm or harmless fertilizers and pesticides can reduce pollution of the agricultural and rural ecological environments to promote the sustainable development of agriculture and contribute to the realization of the goal of Carbon Peak and Carbon Neutrality. On the other hand, China should gradually narrow the development gap between regions to foster green agricultural development. According to the resource conditions of each province (direct-administered municipalities and autonomous regions) and the actual agricultural development, exploring the differentiated and unique mode of green agriculture development. For Beijing, Zhejiang, and other regions with better development of green agriculture, summarizing and promoting their typical practices and successful experiences to offer successful models for the relatively backward regions in the development of green agriculture; for the relatively low level of development of green agriculture in the region, guiding them to fully explore their own characteristics and utilize their own advantages for their own modes with support on relevant policies; Breaking down regional administrative barriers can promote the collaborative development of green agriculture in neighboring provinces and cities, for example, the three provinces in the northeastern region can explore the establishment of a collaborative mechanism for green agricultural development and the development of modern industrial clusters for green agriculture in the northeastern region.

Author Contributions

Ma Shaohua is the sole author. The author read and approved the final manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest.

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