Research Article

The Evaluation and Analysis of the Entropy Weight Method and the Fractional Grey Model Study on the Development Level of Modern Agriculture in Huizhou

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From the level of agricultural material equipment, the level of agricultural output benefit, the level of agricultural economic structure, the level of agricultural industrialization management, the level of agricultural sustainable development, and the level of rural social and economic development, based on 15 indicators, an index system for evaluating the comprehensive capacity of modern agricultural development in Huizhou was constructed. The comprehensive evaluation of the development level of modern agriculture in Huizhou from 2012 to 2018 was measured by the entropy weight method, and the evaluation was analyzed with the average level of Guangdong Province. We find out the gap between the development advantages of Huizhou and the average level of Guangdong Province, so as to promote the development of modern agriculture in Huizhou. Based on the comprehensive evaluation index of the development level of modern agriculture in Huizhou from 2012 to 2018 obtained by the entropy weight method, a fractional cumulative grey GM (1, 1) forecasting model was established, and its development ability was predicted and analyzed. The forecast result has certain guiding significance to the development of modern agriculture in Huizhou.

1. Introduction

Agriculture is the most basic material production sector in the national economy. Whether in China or abroad, whether in the past, present, or in the future, agriculture is the foundation of the national economy. The policy of “agriculture, rural areas and farmers” put forward by the state emphasizes that the development of agriculture should be promoted as well as the increase of peasants’ income. Therefore, in order to realize the important goal of building Xiaokang in an all-round way and promoting socialist modernization in an all-round way, the most fundamental thing is to stress agriculture and strengthen agriculture and Huinong District in order to achieve sustainable and stable development of agriculture and long-term guarantee of effective supply of agricultural products. Modern agriculture, which has been formed since the Industrial Revolution, is gradually moving towards commercialization and

marketization. Agricultural production and management activities have gradually become specialized, intensive, and large scale. Agricultural labor productivity has been greatly improved. Its main characteristics are as follows: the degree of market is increasingly mature, industrial equipment is widely used, advanced technology is widely used, the industrial system is improving day by day, and the ecological environment is valued. As one of the traditional agricultural cities and grain production areas in Guangdong Province, Huizhou has a very suitable climate for the development of crop production and has a relatively mild climate throughout the year. With plenty of rain and sunshine and fertile soil, agricultural resources are also relatively rich. According to the Huizhou Statistical Yearbook, the per capita net income of farmers in Huizhou has reached double-digit growth rate for five consecutive years and has made great achievements in agricultural development. Agriculture is an indispensable part of our city’s national

economy. At the same time, the development of modern agriculture can promote the development of other industries. Therefore, scientific prediction of the economic development of modern agriculture is of great help to the prospect of the development of this city's agricultural economy. It is an extremely important basis for formulating the future agricultural development plan and also helps to promote the safe operation of our city's national economy. And the reasonable forecast method can also increase the science of the policy implementation and the persuasion to the masses, thus reducing the blindness of the decision-making.

Therefore, we should pay attention to the city's modern agricultural development in the future direction of the forecast. At present, accelerating the development of modern agriculture has become a consensus, many experts and scholars have explored the development of modern agriculture from different research perspectives. Zhang and Cang [1] set up indexes including the Agricultural Social Service Index, Agricultural Ecological Environment Index, Agricultural Security Level Index, and Agricultural Comprehensive Productive Capacity Index. Wang and Liu [2] constructed the first-class indexes of the agricultural economic function, agricultural ecological function, agricultural social function, and agricultural modernization level. According to the level of economic development, social development, and ecological development, an index system for evaluating the development level of modern urban agriculture in Tianjin, Hebei, was established by Gao [3]. Wan et al. [4] evaluated the modernization level of urban agriculture in Guangzhou from the classification indexes of production conditions, output benefit, scientific and technological level, ecological environment, and urban and rural overall planning. Fu and Luo [5] evaluated the modernization level of urban agriculture in Guangzhou from the aspects of urban agricultural quality and urban agricultural efficiency. Guo [6] constructed indexes including the comprehensive development level of agriculture, the safety level of agricultural ecological environment, the development level of agricultural society, the security level of urban agriculture, and the comprehensive production level of agriculture to evaluate the sustainable development ability of urban agriculture in Xi'an.

Focusing on the perspective of modern rural areas, Cai et al. [7] pushed forward the optimization of the agricultural structure, innovated the input methods of basic elements in agriculture, brought into play the leading role of the new-type agricultural management main body, and constructed a perfect socialized agricultural service system, effective promotion of sound development of agricultural economy. Liu and Na [8] promoted modern material conditions and equipment agriculture and modern science and technology to transform the agriculture and modern industrial system to upgrade agriculture from a green, circular, and high-end perspective. Luan [9] constantly expanded the quantity and quality of high-quality agricultural products, focused on the cultivation of scientific and technological innovation, and provided the core competitiveness of agricultural products for the perspective of supply-side reform.

Agricultural leading enterprises can promote the level of agricultural industrialization, optimize and adjust the industrial structure, and promote the production, employment, and income of farmers through various forms [10–13]. In recent years, domestic scholars have studied the efficiency of agricultural industrialization and its influencing factors from different angles, mainly focusing on the cluster of agricultural industrialization and agricultural leading enterprises and measuring the efficiency [14–16]. Zhang and Liu [17] established an evaluation index system for high-quality development of agriculture from the aspects of agricultural resources, economic benefits, ecological environment and workers, etc., and through the mold and analytic hierarchy process for the comprehensive evaluation of agricultural high-quality development. There are also some references to rural revitalization and modern agricultural development studies [18–25]. At present, scholars and experts focus on the entropy weight method and fractional grey model to study the development of modern agriculture which is still less. Based on the entropy weight method, this paper constructs the evaluation index system of the development level of modern agriculture, calculates the development status of modern agriculture in Huizhou from 2012 to 2018, and compares it with the average development level of modern agriculture in Guangdong Province from 2012 to 2018, a more accurate and comprehensive assessment of the level of modern agricultural development in Huizhou. We use fractional grey models to predict the level of modern agricultural development in Huizhou.

2. Research Methodology

2.1. Evaluation Index System of Modern Agriculture Development. This paper selects the agricultural data from 2012 to 2018 through the Huizhou Statistical Yearbook and Guangdong Statistical Yearbook and establishes a comprehensive evaluation index model of modern agriculture in Huizhou by using the entropy method. We combined the possibility and significance of obtaining relevant indicators, establishing a modern agricultural development evaluation index system with six secondary indicators, including the level of agricultural materials and equipment, the level of agricultural output and efficiency, the level of agricultural economic structure, the level of agricultural industrialization and management, the level of agricultural sustainable development, and the level of rural social and economic development and selected 15 three-level indicators, as detailed in Table 1.

2.2. The Fundamentals of the Model. In information theory, entropy is a measure of uncertainty. The more the information, the less the uncertainty and the less the entropy; the less the information, the more the uncertainty and the more the entropy. According to the characteristics of entropy, we can judge the randomness and disorder degree of an event by calculating the entropy value, or we can judge the dispersion degree of an index by the entropy value; the more the dispersion degree of the index is, the greater the influence

TABLE 1: Index system for evaluating the development level of modern agriculture and its entropy.

Classification index layer		Single index layer	
Classification index	Entropy	Single index	Entropy
Level of agricultural material equipment	0.0890	Electricity consumption per cultivated area	0.0445
		Fertilizer rate	0.0445
Efficiency level of agricultural output	0.1956	Per capita gross output value of agriculture, forestry, animal husbandry, and fishery	0.0546
		Per capita net income of farmers	0.0591
		Comprehensive yield of land	0.0819
Structural level of agricultural economy	0.2550	Proportion of agriculture, forestry, animal husbandry, and fishery workers in rural areas	0.1443
		The added value of agriculture, forestry, animal husbandry, and fishery services accounts for the proportion of the added value of agriculture, forestry, animal husbandry, and fishery	0.0348
		The added value of animal husbandry accounts for the proportion of the added value of agriculture, forestry, animal husbandry, and fishery	0.0759
Management level of agricultural industrialization	0.0869	Industrial operating rate	0.0869
Sustainable development level of agriculture	0.1038	Per capita arable land	0.0533
		Forest coverage	0.0505
Development level of rural social economy	0.2696	Urbanization rate	0.0346
		Primary sector of the economy as a share of GDP	0.0876
		Per capita electricity consumption in rural areas	0.0549
		Urban-rural income ratio	0.0925

(weight) of the index on comprehensive evaluation is and the smaller the entropy value is. Using the entropy method to determine index weight can overcome the inevitable randomness and supposition of the subjective weighting method. So, this paper uses information entropy to determine index weight to make a comprehensive evaluation of agricultural development in Huizhou.

2.3. Comprehensive Evaluation Model of the Agricultural Development Level Based on the Entropy Weight Method. The entropy weight method is calculated as follows.

If there are m evaluated objects and n evaluation indexes and y_{ij} ($1 \leq i \leq m$, $1 \leq j \leq n$) is the i index of the j evaluated object, then the decision matrix is $Y = (y_{ij})_{m \times n}$. Different algorithms are used to conduct data standardization processing for positive and negative indicators. The positive indicators are standardized according to equation (1), while the negative indicators are standardized according to equation (2):

$$x_{ij} = \frac{y_{ij} - \min(y_{ij})}{\max(y_{ij}) - \min(y_{ij})}, \quad (1)$$

$$x_{ij} = \frac{\max(y_{ij}) - y_{ij}}{\max(y_{ij}) - \min(y_{ij})}. \quad (2)$$

Secondly, in order to ensure that the weight of the entropy method can be carried out by the logarithmic operation, the translation data should be carried out according to the following formula:

$$z_{ij} = x_{ij} + 0.5, \quad z_{ij} \in [0.5, 1.5]. \quad (3)$$

Again, the index value after translation is transformed according to the following formula:

$$h_{ij} = \frac{z_{ij}}{\sum_{i=1}^m z_{ij}}. \quad (4)$$

We obtain matrix $H = (h_{ij})_{m \times n}$ as the normalized value of the evaluation index of the modern agricultural development level.

Finally, we calculate the entropy value of each index according to formula (5) and calculate the entropy weight value of the j -th index according to formula (6):

$$f_j = -k \sum_{i=1}^m h_{ij} \ln h_{ij}, \quad j = 1, \dots, n, \text{ where } k = 1/\ln m, \quad (5)$$

$$w_j = \frac{1 - f_j}{n - \sum_{j=1}^n f_j}, \quad 1 \leq j \leq n. \quad (6)$$

Using the data of various indicators in Huizhou from 2012 to 2018, after calculation, the weight vector of the evaluation indicators of the modern agricultural development level is finally obtained, as shown in Table 1.

2.4. Comprehensive Evaluation Index of the Modern Agricultural Development Level. For calculation and comparison, the classification index and comprehensive evaluation index of the modern agricultural development level adopt the linear weighting method, and the calculation formula is

$$s_i = \sum W_j \times H_{ij}, \quad 1 \leq i \leq m, 1 \leq j \leq n. \quad (7)$$

Among them, s_i is the evaluation index of the modern agricultural development level; W_j is the weight of the j -th index; and H_{ij} is the normalized value of the index.

Using the evaluation index system and evaluation criteria and the data and analysis results of Huizhou city and Guangdong Province, the vertical comparison (Tables 2 and 3) and horizontal comparison of the development level of modern agriculture in Huizhou city from 2012 to 2018 are carried out.

2.5. Fractional Cumulative Grey Model Predicts the Comprehensive Evaluation Index of the Modern Agricultural Development Level. In 2013, Wu et al. [26] proposed a grey model, fractional cumulative grey GM (1, 1) prediction model, which is based on the new information priority principle, with the help of the “in between” idea contained in the fractional order [27]; by selecting a reasonable accumulation order, the high-growth data sequence becomes smooth, and the prediction accuracy of the model is improved. Wu et al. [28] applied the univariate nonhomogeneous grey model to study CO₂ emissions for BRICS countries without the consideration of external factors. Under several error metrics, one can see that grey forecasting models can provide excellent results for the five countries. Based on the definition of the conformable fractional derivative, Ma et al. [29] proposed the conformable fractional accumulation and difference. Then, a novel conformable fractional grey model is proposed based on the conformable fractional accumulation and difference, and the brute force method is introduced to optimize its fractional order.

Wu et al. [30] proved that the nonhomogenous discrete grey model (abbreviated as NDGM) with the first accumulated generating operator violates the principle of new information priority and principle of minimal information of grey system theory. A new NDGM with the fractional-order accumulation is put forward. Grey convex relational analysis was used to describe the relationship between the electricity consumption and its related factors by Wu et al. [31]. A novel multivariable grey forecasting model which considered the total population was developed to forecast the electricity consumption in Shandong province. Based on the nonhomogeneous grey model, the conformable fractional nonhomogeneous grey Bernoulli model was developed by Zheng et al. [32] for estimating natural gas production and consumption. In the new method, the Bernoulli equation was first introduced into the existing differential equation. Liu et al. [33] reconstructed a dynamic background value for the fractional grey model by the composite integral median theorem; as a result, they proposed a novel fractional grey model-based variable background value. As far as we know, there are few literature studies on the study of the modern agricultural development index using the fractional-order grey prediction model. So, we apply this method to study the modern agriculture of Huizhou.

2.6. Fractional Cumulative Modeling

- (1) Input the original time series data: select a small amount of the historical data according to the forecast target:

$$U^{(0)} = \{u^{(0)}(1), u^{(0)}(2), \dots, u^{(0)}(n)\}. \quad (8)$$

- (2) The r -order cumulative sequence of the original data $U^{(0)}$ is

$$u^{(k)}(r) = \sum_{i=1}^k C_{k-i+r-1}^{k-i} u^{(0)}(i). \quad (9)$$

Calculate $U^{(r)} = \{u^{(r)}(1), u^{(r)}(2), \dots, u^{(r)}(n)\}$; if the future scene belongs to short memory, set the order $r \in (0, 0.5)$; if the future scene belongs to long memory, set the order $r \in (0.5, 1)$. Among them, $C_{r-1}^0 = 1, C_k^{K+1} = 0, k = 0, 1, \dots, n-1$, and

$$C_{k-i+r-1}^{k-i} = \frac{(k-i+r-1)(k-i+r-2) \cdots (r+1)r}{(k-i)!}. \quad (10)$$

GM (1, 1) model parameter estimation: calculate the background value of the r -order cumulative sequence:

$$v^{(r)}(k) = 0.5[u^{(r)}(k) + u^{(r)}(k-1)], \quad k = 2, 3, \dots, n. \quad (11)$$

Obtain matrices

$$B = \begin{bmatrix} -v^{(r)}(2) & 1 \\ -v^{(r)}(3) & 1 \\ \vdots & \vdots \\ -v^{(r)}(n) & 1 \end{bmatrix}, \quad (12)$$

$$D = \begin{bmatrix} u^{(r)}(2) \\ u^{(r)}(3) \\ \vdots \\ u^{(r)}(n) \end{bmatrix}.$$

Use least squares to find parameters

$$\begin{bmatrix} \hat{a} \\ \hat{b} \end{bmatrix} = (B^T B)^{-1} B^T D. \quad (13)$$

Determine the model: substitute the parameters $\hat{a}$ and $\hat{b}$ into the time response function of the GM (1, 1) model:

$$\hat{u}^{(r)}(k+1) = \left(u^{(0)}(1) - \frac{\hat{b}}{\hat{a}} \right) e^{-\hat{a}k} + \frac{\hat{b}}{\hat{a}}. \quad (14)$$

Predicted $\hat{u}^{(r)}(1), \hat{u}^{(r)}(2), \dots$

- (3) Accumulation and subtraction of the r -order sequence: change $U^{(r)} = \{\hat{u}^{(r)}(1), \hat{u}^{(r)}(2), \dots, \hat{u}^{(r)}(n), \dots\}$ to accumulate for order $1-r$, and then accumulate and subtract for order 1, which is

TABLE 2: Evaluation index of the development level on modern agriculture of Huizhou city.

Year	Classification index						Comprehensive evaluation
	Agricultural equipment	Agricultural production efficiency	Agricultural economic structure	Industrial management of agriculture	Agricultural sustainable development	Rural social and economic development	Development of modern agriculture
2012	0.0212	0.0001	0.0736	0.0001	0.0056	0.099	0.1996
2013	0.0154	0.0084	0.0229	0.0002	0.0126	0.0382	0.0976
2014	0.0056	0.0142	0.0178	0.0258	0.0185	0.0332	0.1151
2015	0.0135	0.0242	0.02	0.0261	0.0246	0.0246	0.1330
2016	0.0099	0.0408	0.0154	0.0184	0.0273	0.0306	0.1423
2017	0.0133	0.0488	0.0702	0.0088	0.0087	0.0248	0.1747
2018	0.0100	0.0591	0.0352	0.0076	0.0065	0.0192	0.1377

TABLE 3: Evaluation index of the development level on modern agriculture of Guangdong Province.

Year	Classification index						Comprehensive evaluation
	Agricultural equipment	Agricultural production efficiency	Agricultural economic structure	Industrial management of agriculture	Agricultural sustainable development	Rural social and economic development	Development of modern agriculture
2012	0.0057	0.0001	0.0265	0.0001	0.0233	0.1028	0.1584
2013	0.0075	0.0057	0.0199	0.0059	0.0240	0.0455	0.1084
2014	0.0137	0.0189	0.0209	0.0044	0.0219	0.0355	0.1133
2015	0.0179	0.0221	0.1397	0.0080	0.0161	0.0360	0.2399
2016	0.0202	0.0344	0.0236	0.0122	0.0099	0.0319	0.1321
2017	0.0140	0.0399	0.0242	0.0041	0.0095	0.0310	0.1227
2018	0.0112	0.0492	0.0169	0.0070	0.0075	0.0334	0.1252

$$\alpha^{(r)}U^{(0)} = \{\alpha^{(1)}\hat{u}^{(1-r)}(1), \alpha^{(1)}\hat{u}^{(1-r)}(2), \dots, \alpha^{(1)}\hat{u}^{(1-r)}(n), \alpha^{(1)}\hat{u}^{(1-r)}(n+1), \dots\}. \quad (15)$$

Calculate the fitted value $\hat{u}^{(0)}(1), \hat{u}^{(0)}(2), \dots, \hat{u}^{(0)}(n)$ and the predicted value $\hat{u}^{(0)}(n+1), \hat{u}^{(0)}(n+2), \dots$

- (4) Error test: perform the residual test, correlation test, or calibration error probability test for $\hat{u}^{(0)}(1), \hat{u}^{(0)}(2), \dots, \hat{u}^{(0)}(n)$, judge the fitting effect of the model according to the test result, and qualitatively analyze the prediction accuracy of the model; if the fitting accuracy is not ideal, the cumulative order can be adjusted r , that is, return to formula (1) until the accuracy reaches the ideal state.

3. Evaluation and Analysis of the Development Level of Modern Agriculture in Huizhou

3.1. Analysis of Classification Index Evaluation Results. (1)

Agricultural material equipment level indicators: according to Figure 1, the agricultural material index of Huizhou city has shown a clear downward trend. It was 0.0100 in 2018, which was about 0.47 times that of 2012, mainly due to the continuous decline in electricity consumption per unit of the cultivated land. As shown in Figure 2, from 2012 to 2018, the agricultural material equipment level index of Guangdong Province increased first and then decreased and remained basically the same as Huizhou in the next two years.

- (2) Index of the agricultural output benefit level: as shown in Figure 1, Huizhou's agricultural output benefit level index showed a clear trend of injury. The index in 2018 was more than 500 times that in 2012. As shown in Figure 2, from 2012 to 2018, Huizhou's agricultural output benefit level index was higher than the average level of Guangdong Province, increasing from 0.0027 in 2013 to 0.0099 in 2018; in 2014, it was lower than the evaluation level of Guangdong Province and lower than 0.0047.

- (3) Agricultural economic structure indicators: according to Figures 1 and 2, Huizhou's agricultural economic structure level index has relatively large fluctuations. The index was the lowest in 2016, and the index was the highest in 2012; the indexes in 2012 and 2018 were 0.0736 and 0.0352, respectively. The former was 2.09 times the latter. Compared with Guangdong Province, except in 2014–2016, the agricultural economic structure index in Huizhou city was higher than the average level of Guangdong Province. The gap in 2012 was 0.0471, the gap in 2018 was 0.046, and the gap in 2015 was -0.1197 .

- (4) The index of the agricultural industrialization management level: as shown in Figures 1 and 2, the agricultural industrialization management level

FIGURE 1: Indicators of the level of the development of modern agriculture in Huizhou.

FIGURE 2: Indicators of the level of the development of modern agriculture in Guangdong.

index of Huizhou city has shown a clear trend of first rising and then falling, reaching a maximum of 0.0261 in 2015. Compared with Guangdong Province, Huizhou agricultural industrialization management level index was lower than the average level of Guangdong Province in 2013, and higher than the average level of Guangdong Province in other years from 2012 to 2018. The gap was the largest in 2014, which was higher than 0.0214; in 2012 and 2018, the two levels were comparable.

- (5) Indicators of sustainable agricultural development: it can be seen from Figures 1 and 2 that the agricultural sustainable development index of Huizhou city first

rose and then fell, reaching a maximum of 0.0273 in 2016, and it was basically the same in 2012 and 2018. Compared with Guangdong Province, only the agricultural sustainability index of Huizhou in 2015 and 2016 was higher than the average level of Guangdong Province, and the rest of the time, it was lower than the average level of Guangdong Province.

- (6) Indicators for the level of rural social and economic development: as shown in Figures 1 and 2, Huizhou's rural social and economic development level index was decreasing year by year, but the decrease was not large. The index in 2012 was about 5.15 times that in 2018. Compared with Guangdong Province, Huizhou's rural social and economic development level index is lower than the average level of Guangdong Province, with the largest gap being 0.0142 in 2018 and the smallest being 0.0002 in 2014.

3.2. Analysis of Comprehensive Evaluation Results. According to Table 2 and Figure 3, from 2012 to 2018, the comprehensive evaluation index of Huizhou's modern agricultural development level showed an alternating trend. The comprehensive evaluation index in 2018 was 0.1377, which was approximately 0.69 times that in 2012. Compared with the evaluation level of modern agricultural development in Guangdong Province, the comprehensive evaluation index of the modern agricultural development level of Huizhou was slightly lower in 2013 and 2015 and higher in other years. Among them, 2017 was higher than 0.052.

4. Using the Fractional Cumulative Grey Model to Predict the Comprehensive Evaluation Index of Modern Agriculture

From the data in Table 2, we obtain the original data sequence:

FIGURE 3: Index change of comprehensive evaluation on the development level of modern agriculture.

TABLE 4: Estimated and predicted values of three different models.

Model	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	MAPE (%)
ARIMA	0.1996	0.1716	0.1237	0.1107	0.1249	0.1428	0.1871	0.2221	0.2690	0.3347	26.980
GM	0.1996	0.1089	0.1178	0.1273	0.1376	0.1488	0.1608	0.1739	0.1879	0.2032	8.852
FGM	0.1996	0.1141	0.1177	0.1261	0.1361	0.1468	0.1582	0.1702	0.1829	0.1963	8.510

$$U^{(0)} = \{0.1996, 0.0976, 0.151, 0.1330, 0.1423, 0.1747, 0.1377\}. \quad (16)$$

In order to achieve the best simulation prediction effect, the optimal fractional order r should be determined, and the average relative error function (MAPE) should be constructed here. Then, the relationship between the fractional order r and the parameter $\hat{a}, \hat{b}$ is used as the constraint condition, and Python software is used to program the nonlinear optimization problem with the minimum average relative error as the objective function. Through Python programming and the formula in Section 2.6, the optimal fractional order r is 0.8.

The simulation value of the comprehensive evaluation index of the modern agricultural development level from 2012 to 2018 and the predicted value from 2019 to 2021 are given in Table 4. We use the grey prediction model and time series model to estimate and forecast the original data. We also get MAPE = 8.510% of the fractional cumulative grey model, which is smaller than that of the other two methods.

5. Conclusion

After research and analysis, Huizhou's modern agricultural construction has achieved positive results. The level of agricultural output and the level of agricultural industrialization management are higher than the average level of Guangdong Province, indicators such as agricultural material equipment level, agricultural economic structure, agricultural sustainable development level and rural social and economic development level are slightly lower than the average level of Guangdong Province. These are the focus of

Huizhou's future modern agricultural construction and development. In the research of grey forecasting, the fractional cumulative model is a hot spot in recent years. This paper established a fractional cumulative grey GM (1, 1) model to predict the comprehensive evaluation index of modern agricultural development in Huizhou. We obtained the predicted value of such indicators from 2019 to 2021. We found that the prediction worked very well. Using the novel conformable fractional nonhomogeneous grey model and nonhomogenous discrete grey model with fractional-order accumulation for forecasting Huizhou's modern agriculture is our future work.

Data Availability

The data that support the findings of this study are openly available in Statistical Yearbook of Guangdong Province at <https://data.cnki.net/area/Yearbook/Single/N2011090056?z=D19>.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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