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Synergistic Interconstruction of the Green Development Concept in Chinese Rural Ecological Agriculture

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Abstract: The development of industrialization has overwhelmed an ecological environment damaged by the modern agricultural method. The development of a circular economy, which focuses on green development while balancing the development of agricultural production capacity, has led to the emergence of ecoagriculture. This study examines the impact of the green development concept on farmers' income, using the practice of the green development concept of ecoagriculture in Guangdong province, China, as an example. The study uses the entropy method to verify whether the green development concept advocated by top-down policies genuinely benefits farmers' living standards. The study results are as follows. First, the green development concept's application in Guangdong province's agricultural production and the two-way granger causality relationship between farmer income and food production interact. Second, chemical fertilizers and pesticides have played an important role in promoting the development of agricultural production. Third, in the long run, the greater the use of chemical fertilizers and pesticides will reduce farmers' incomes. In summary, from the perspective of sustainable development, green development will promote increased income for China's farmers and improve rural development. It is essential to implement the concept of green development in the process of rural modernization.

Keywords: ecological agriculture; green development; sustainable development

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1. Introduction

American soil scientist William Albreich first proposed the concept of ecological agriculture in 1971 as the use of organic fertilizers being conducive to establishing good soil conditions and good crop health. Chemical fertilizers, applied in small amounts, are nutritionally beneficial for crops. However, chemical pesticides cannot be used since, by the time they reach insecticidal concentrations, they already pollute the environment [1]. In 1981, M.K. Orhthington a British geologist put forward a new understanding of ecological agriculture as a small agricultural system that is ecologically self sustaining has low input, has economic vitality, and does not produce large, long-term, and unacceptable changes in environmental, ethical, and aesthetic aspects [2]. In 1983 the German chemist Justus von Liebig pointed out that modern agriculture is a kind of predatory agriculture [3]. Therefore, the definition of ecological agriculture in this study is a new type of agricultural production in line with the concept of green development. This new approach requires the safe use or nonuse of synthetic fertilizers and pesticides under good ecological conditions through a resource recycling approach [4]. The new agricultural production mode combines the essence of traditional agriculture with modern production management and science and technology. This new way ensures the safe production of high-quality agricultural products and a virtuous cycle between production and ecology [5]. This study aims to empirically analyze the impact of the application of the concept of green development in agriculture on farmers' income, propose the necessity and relevance of green development to improve farmers' living standards, and provide substantial data support for the shift from green development to green governance.

2. Theoretical Lenses

From an ecological crisis to green development. In 1962, Rachel Carson, an American popular science writer, opened the prelude of the ecomovement through the book *Silent Spring*. The author saw the environmental damage caused by agricultural fertilizer pollution and recognized the ecological sacrifice behind industrial civilization [6]. The most alarming of all human attacks on the environment is the pollution of the air, land, rivers, and sea with dangerous, even deadly, substances that are largely irreversible. As mankind enters the 21st century, the ecological crisis has not abated and seems to be intensifying as industrial civilization continues to develop. In *The Consequences of Modernity*, Anthony Giddens (2011) warns that the ecological dangers we face today appear to be similar to the natural disasters that befell premodern times [7]. The ecological threat is the result of socially organized knowledge, constructed through the impact of industrialism on the material world. This is a new risk profile introduced by the advent of modernity. The ecological crisis and the ecological risks arising from the radical development of modern industrial civilization have made it impossible for ecologists at home and abroad to look on [8].

From the formulation of the problem to the prevalence of theory and practice, ecologists in the West have been developing for more than half a century [9]. Nowadays, ecologism is spreading and practiced in Chinese society, with its roots in China. The systemic nature of ecology and the scarcity of resources, coupled with the severity of environmental pollution, have forced the reform of the green development system, built the skeleton of the green development system, and erected the pillars and beams for the green development practice of the real society [10]. Addressing the growing prominence of ecological and environmental degradation requires first revealing the problems that still exist in China's development approach [11]. One effective way to do this is to look for crude production enterprises with high energy consumption, high emissions, and high pollution in areas where natural resource constraints are tightening, and the industrial economy is growing rapidly [12]. We will conduct a "diagnosis" of their local development plans. To find out the "limited rationality", "rule-avoidance" and "burden-shifting" in the implementation of their development philosophy, development paths, and development strategies that hinder the transformation of the industrial structure and the development of technological upgrading. The constraints to the development of industrial restructuring and technological upgrading.

From the point of view of sustainable development, China can no longer afford to develop production at the expense of the environment [13]. Green development is closely related to ecological agriculture. The impact of the way agriculture is developed on the income levels of farmers will be intuitively reflected in the necessity and relevance of green development for rural development [14]. To relate environmental theory to the objective world, it needs to be linked to all political, social, and economic forces. In the real world, there is the problem of soil pollution caused using excessive fertilizers, pesticides, and mulch in agricultural development [15]. Increases in food production and farmers' income are pitted against environmental concerns. The question of how to weigh the priorities of agricultural development to ensure that farmers can improve their living standards while protecting the ecological environment from damage is an urgent issue to be addressed in the modernization of agriculture.

3. Materials and Methods

3.1. Research Context

Development communication theory was born in the 1950s and means "development + communication", with development projects mostly linked to communication. Based on Rogers' diffusion of innovation theory, Jan and Patchance analyzed the history of development communication and the evolution of several paradigms, the content and methods of the participation paradigm, and examples of development communication projects planned under the participation paradigm and the evaluation of their effectiveness [16]. It can be summarized in three main sections: the basic theory of development communication, the meaning and methods of participatory communication, and the practice of development communication [16]. It systematically compares the essence of what development communication is and how it can be used to promote development. Among the many development projects, its topics of concern include rural development and the state of being. In this paradigm of thinking, communication is seen as a dynamic social process, thus providing a clearer insight into the context and practice of rural development in its historical dimension. The data selection proposed for this study is ephemeral, with specific data on agricultural development in Guangdong province over a 20-year period selected as the primary data for the study, and thus, at this level, development communication science can be used as a theoretical basis to some extent. Thus, this study complements the theoretical basis with empirical research.

3.2. Study Area

Guangzhou in China is the most economically vulnerable city in China to sea-level rise. It is estimated that if emissions are left unchecked, Guangzhou will lose $331 billion per year by 2050, a figure that will rise to $1.4 trillion by 2100 [17]. If emissions can be reduced rapidly, this figure could be limited to $254 million annually by 2050 [18]. Continued global warming can be seen to further impact China's economy. Global climate change can directly influence labor productivity in agricultural industries. It will also disrupt international supply chains, markets, finance, and trade hard, potentially affecting the regular supply of Chinese domestic commodities, which could lead to increased prices, while potentially disrupting export markets for Chinese commodities [19]. The impact of climate change and the world economy, such as reduced agricultural production, damage to critical infrastructures, and higher commodity prices, could further destabilize financial markets. Not only will climate change directly affect China, its impact on other countries could be felt indirectly [20]. Thus, a response to global climate change should be on the horizon.

Based on the development perspective of communication theory and the connotation of green development [16,17], the impact of communication and application on agricultural development is the objective of this case study. To facilitate data analysis, the application of the green development concept in agricultural development is transformed into the use of agricultural fertilizers, pesticides, agricultural diesel, and plastic films in agricultural production to demonstrate the impact of the agricultural green development mode on farmers' income levels. Construction of the agricultural green development level index based on previous studies [21–24], we selected four consumption data on pesticide, mulching film, chemical fertilizer, and agricultural diesel [25] to construct an indicator system of the green development concept. The purpose of this study is to analyze the impact of agricultural green development on farmers' income in Guangdong province. This study evaluates the level of green agricultural development in Guangdong by analyzing the consumption of pesticides, plastic films, fertilizers, and agricultural diesel from 2013 to 2020 and constructing a green development concept indicator system.

In this study, the consumptions of pesticide, plastic mulch, fertilizer, and agricultural diesel fuel were each used as explanatory variables. The per capita disposable income and per capita consumable expenditure of rural residents from 2013–2000 were selected as explanatory variables, while grain production from 2000–2020 was selected as an explanatory variable. dis: damaged area (thousands of hectares); crops: sown area of food crops (thousands of hectares) and total wealth: total sown area of crops (thousands of hectares) as control variables.

The indicators of the green development concept constructed in this study are as follows. first is typicality. The index system selected in this paper aims to comprehensively reflect the influence of agricultural green development levels on farmers' income in Guangdong province, highlight the nonlinear characteristics and trends of agricultural green development in Guangdong province, and outline the pulse of ecological agriculture development in Guangdong province. The second is feasibility. Based on the determination of the existing indicator system, the required indicator data are extracted from the public data of the National Bureau of Statistics of China to ensure the accuracy and completeness of the data. The third is a high degree of correlation. This study aims to empirically analyze the impact of the application of the concept of green development in agriculture on farmers' income, to propose the necessity and practical significance of green development in improving farmers' living standards, and to provide substantive data support for the shift from green development to green governance. Based on the definition of ecoagriculture and the knowledge of the connotation of green development [26,27], the evaluation indicators of the level of green development in agriculture are the amount of chemical fertilizer, the amount of plastic film, the number of pesticides, and the amount of agricultural diesel.

3.3. Research Steps

The meaning of indicator weights in the evaluation model refers to the degree of contribution of each indicator to the evaluation results in the multi-indicator evaluation system. The reasonableness of the weights is directly related to the reliability of the results [25]. The entropy method will be chosen for this study. The concept of entropy originally came from the measurement of system disorder in thermodynamics [28]. In addition to the innovative information theory model of propagation, informaticians have also introduced the concept of information entropy. Entropy can be used to measure uncertainty and to determine the degree of randomness and disorder in various things. The empirical analysis of the impact of the green development concept on farmers' income levels involves research in the realm of economics.

In order to ensure the validity and reliability of the research results, the entropy method is adopted as an interdisciplinary empirical analysis method [29]. In the process of the comprehensive evaluation, the greater the dispersion of the index value, the more significant the impact of the index on the evaluation result [30]. Therefore, entropy can be used to judge the dispersion of the index to obtain the importance of the evaluation index to the evaluation result, that is, the weight of the evaluation index. The entropy method takes the difference of the initial data of each index as the basis of index weight and has strong objectivity [31]. Therefore, when measuring the indicator level of the green development concept, the entropy method is used to determine each indicator's weight, making the measurement results more objective.

3.4. Research Method

To study whether there is an exact long-term equilibrium relationship between the application of the green development concept, farmers' income, and grain yield, the VAR model can be established for analysis. The vector autoregressive model (VAR model) is a commonly used econometric model [32]. In establishing the VAR model, it is necessary first to determine the variables selected by the model. In general, the correlation between selected variables is the premise of establishing the VAR model and then determining the lag order, P, of the model [25]. VAR models generally do not impose constraints on the significance of parameter estimates, and the explanatory variables usually do not include current variables, hence, the simultaneous equation models are proper to apply [33]. Large samples are usually used to establish VAR models to ensure their accuracy [34]. The sample size selected in this study spans 20 years, which is in line with the sample orientation of the VAR model. Based on the measurement of relevant indicators in Guangdong Province from 2000 to 2020, the VAR model is established to provide a reasonable way to study the relationship between green development and farmers' income.

3.5. Indicators and Data Sources

The original data for the study were selected from publicly available statistics on the use of pesticides, mulch, fertilizers, and agricultural diesel in agricultural production over the past 20 years of ecological agricultural development in Guangdong province. In recent years, the total agricultural output value of Guangdong province has steadily increased, and the per capita net income of farmers has been rising. However, there are still large gaps in the development of agriculture in various cities [35]. The plantation industry is mainly concentrated in the western and northern parts of Guangdong. Among the many types of agroindustry, vegetable cultivation is mainly concentrated in the cities of Zhanjiang, Guangzhou, Qingyuan, Huizhou, Maoming, and Shaoguan [35]. In terms of farming, western Guangdong is dominant in aquaculture and livestock farming (cattle and sheep farming) in Guangdong Province. The northern part of Guangdong performs well in livestock farming, second only to the western part of Guangdong, while the coastal areas of the eastern part of Guangdong have an advantage in aquaculture, which is the characteristic aquaculture base of Guangdong Province [36]. Zhaoqing in the northern part of the Pearl River Delta and Yangjiang in the northwest have an advantage in livestock farming. The coastal areas of Guangzhou, Zhongshan, Zhuhai, and Yangjiang mainly develop aquaculture [36]. Fruit farming is mainly located in the mountainous areas of western and northern Guangdong and in the regions of Zhaoqing, Guangzhou, and Huizhou [37].

According to the available data from the China National Bureau of Statistics, 19 years and 31 indicators from 2001 to 2019 were selected, and xij is the value of the jTH indicator in the ith year. The normalization of the index deals with heterogeneous homogeneity. Since the units of measurement of each indicator are not uniform, it is necessary to standardize them before calculating the comprehensive indicator. The absolute value of the index into relative and xij = ∣xij∣, to solve the different qualitative index of the homogeneity problem [38]. Further, since the values of positive and negative indicators represent different meanings, the higher the value of positive indicators, the better, and the lower the value of negative indicators, the better [39]. Therefore, different algorithms will be used for data standardization processing for high and low indicators [40,41]. This step can be omitted if all of the explained variables in this study are positive indicators.

Calculate the proportion of year i in the jTH index. To eliminate the error caused by missing values of some variables in some years in the calculation, p_{ij} index used is p_{ij} + 0.00001.

$$p_{ij} \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}, i = 1, \ldots, n; j = 1, \ldots, m \tag{1}$$

Calculate the entropy value of the jTH index, where k = 1/ln(n), so that $e_j \geq 0$

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}) \tag{2}$$

Calculate the redundancy of information entropy:

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

Calculate the weight of each indicator:

$$p_{ij} = \frac{d_j}{\sum_{j=1}^{m} d_j} \tag{4}$$

Calculate the composite score for each year:

$$s_i = \sum_{j=1}^{m} w_j p_{ij} \tag{5}$$

The stationarity analysis and test of time series is an important content of modern econometrics and time series analysis. ADF and DF unit root tests are the most widely used [42]. Therefore, this study also adopts such methods with stationarity characteristics for data analysis, as shown in Table 1 below for the unit root test.

Table 1. Unit root test.

ADF Unit Root Test							
The Variable Name	Terms of Inspection	t-Distribution			t	Prob	Whether or Not Smooth
		1%	5%	10%			
x	(c,0,0)	−3.85739	−3.04039	−2.66055	−1.48013	0.5203	nonstationary
D_x	(c,0,0)	−3.88675	−3.05217	−2.66659	−4.89222	0.0014	smooth
y	(0,0,0)	−2.69977	−1.96141	−1.60661	1.881066	0.9811	nonstationary
D_y	(0,0,0)	−2.70809	−1.96281	−1.60613	−3.11415	0.0039	smooth
dis	(c,0,1)	−3.88675	−3.05217	−2.66659	−1.78308	0.3753	nonstationary
D_dis	(c,0,0)	−3.88675	−3.05217	−2.66659	−9.18903	0	smooth
crops	(c,t,0)	−4.57156	−3.69081	−3.28691	−2.94692	0.1723	nonstationary
D_crops	(c,t,1)	−4.66788	−3.7332	−3.31035	−5.02712	0.0054	smooth
total_sown	(c,0,0)	−4.57156	−3.69081	−3.28691	−1.36031	0.8372	nonstationary
D_total_sown	(c,0,0)	−4.61621	−3.71048	−3.2978	−4.89999	0.006	smooth

First, the stationarity test of the time series to be studied is carried out. This paper uses Eviews10.0 software to carry out the ADF unit root test. Among the test types, C stands for constant term, t stands for trend term, K stands for lag order, the selection of lag period follows SIC criterion, the highest lag term is 1 period, and D_ stands for difference form [42]. According to Table 1 above, at a 5% confidence level, the series of control variables, explanatory variables, and explained variables are all nonstationary. Further, the ADF test was conducted on the first-order differences between control variables, explanatory variables, and explained variables. The results showed that the first-order difference series of explained and explained variables were stationary at a 5% confidence level. The inspection method shall be the inspection mentioned above type. When the value of t is less than the value in t-distribution, it is significant at a certain level of significance. For example, if the 5%-t-distribution value of Dx is −3.05217, then a t value less than −3.05217 is a stationary process at the significance level of 5%. The experimental results show that all the variables will become stationary after the first difference.

4. Findings

Based on the weight analysis of the above calculation formula, the following model construction analysis can be obtained.

4.1. Descriptive Statistics

The entropy method of determining the weight of each indicator avoids the random speculation caused by the subjective weighting method and addresses the problem of redundancy of information between variables. The descriptive statistics in Table 2 present a visual representation of the data analysis sample. The unit root tests, etc., which follow in succession, fall within the scope of the entropy method mentioned earlier.

Table 2. Descriptive statistics.

	Y	X	CROPS	DIS	Tot_SOWN
Mean	609.284	4627.357	2448.800	870.495	4434.842
Median	383.614	4923.606	2386.330	842.400	4277.450
Maximum	1226.248	5541.470	3125.600	1978.000	5193.070
Minimum	343.359	3379.043	2151.040	145.000	4178.170
Std. Dev.	332.825	800.656	286.118	450.299	314.968
Skewness	0.718	−0.341	0.907	0.682	1.201
Kurtosis	1.755	1.410	2.755	3.294	2.943
Jarque–Bera	2.861	2.369	2.653	1.539	4.573
Probability	0.239	0.306	0.265	0.463	0.102

The contents of the above table are reflected in the distribution of explanatory variable X, explained variable Y, and relevant control variables in terms of mean, standard deviation, skewness, and kurtosis.

4.2. Determination of Lag Order and Cointegration Test

Johansen cointegration test steps are required when the variables are stationary in the same order. In Table 3 below, lag represents the lag order. LR, AIC, and SC are all statistics. For example, AIC is the Akaike information criterion statistic. According to the position of *, lag is integrated to select the lag order. The * sign of this test is distributed in the lag order two and three. Since too many lag orders have a terrible influence on modeling, we try to select less lag order in the actual statistical analysis, that is, lag order two.

Table 3. Lag order test table.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−526.872	NA	5.15×10^{22}	66.484	66.725	66.496
1	−463.758	78.893	5.32×10^{20}	61.720	63.168	61.794
2	−351.346	70.25726 *	3.74×10^{16} *	50.793	53.449	50.929
3	1569.471	0	NA	−186.1838 *	−182.3209 *	−185.9860 *

After the unit root test, it is necessary to conduct the cointegration test for the time series in the current study. This study used Johansen's maximum likelihood estimation method to conduct the cointegration test. Before the cointegration test, the optimal lag order was determined as order one by the comprehensive method.

As shown in the cointegration test results in Table 4 below, the prob is calculated by the trace statistic. The relationship is significant when the trace statistic is greater than the critical value of 5% (* will be marked after the null hypothesis). What needs to be paid more attention to in the study is whether there is a * after none; that is, whether the selected variables have a long-term equilibrium relationship.

Table 4. Cointegration test table.

Null Hypothesis	Eigen-Value	Trace Statistic	5% Critical Value	Prob
None *	0.96051	135.1233	60.06141	0
At most 1 *	0.930043	83.41578	40.17493	0
At most 2 *	0.785586	40.85768	24.27596	0.0002
At most 3 *	0.634838	16.22017	12.3209	0.0106
At most 4	0.006327	0.101554	4.129906	0.7932

Table 5 is the coefficient table of the cointegration equation. As can be seen from this table, at the 5% confidence level, there are at least three cointegration equations among variables; that is, there is a long-term dynamic equilibrium relationship among variables.

Table 5. Cointegration equation coefficient table.

Y	X	DIS	CROPS	TOTAL_SOWN
1	0.24221	−1.531924	6.047169	−3.48553
	−0.05829	−0.1127	−0.54855	−0.342

Moreover, the cointegration equation is:

$$Y + 0.24221X - 1.531924DIS + 6.047169CROPS - 3.48553TOTAL\_SOWN = 0$$

The cointegration test shows that there is a cointegration relationship between series, however, whether the long-term equilibrium relationship causes the change of the dependent variable or the dependent variable requires a Granger causality test.

4.3. Granger Test

Table 6 above shows that the null hypothesis is rejected at the 5% confidence level, that is, X is the Granger cause of Y. When the prob value is less than 0.05, the null hypothesis is rejected, meaning there is significant Granger causality. The F-statistic calculates the value of prob, and obs is the number of variable observations which can be ignored in the actual operation.

Table 6. Granger test.

Null Hypothesis:	Obs	F-Statistic	Prob.
X does not Granger Cause Y	18	4.97296	0.0414
Y does not Granger Cause X		0.17096	0.6851

4.4. VAR Model

According to the comprehensive method in Table 3 above, the optimal lag order of VAR is determined to be order two, and the VAR model is constructed as shown in the following table.

In Table 7 below, the right-hand side of each variable is followed by three rows of values. The coefficient value is first, the standard error is second, and the third is the T-statistic. Taking total_richness (−1), for example, the coefficient is 0.827; The standard error is −1.19567 and the t-statistic is 0.692. The coefficient represents the richness of the influence. For example, the total_richness (−1) coefficient is 0.827, which means that when other factors remain unchanged, the richness of the explained variable Y will rise by 0.827 units every time total_richness (−1) increases one unit. The t-value test indicates whether a variable significantly impacts the explained variable.

The number in parentheses after the variable refers to the lag order. For example, the total_richness (−1) means to lag the total_richness variable for one year. The goodness of fit refers to the degree to which the regression line fits the observed values. The statistic that measures the goodness of fit is the coefficient of determination R squared, whose maximum value is one. The value of R^2 is getting closer and closer to one, which means that the regression line fits the observation better. On the contrary, the smaller the value of R^2 is, the worse the fitting degree of the regression line to the observed value is, which reflects the explanatory ability of the regression equation to the dependent variable. Therefore, attention should be paid to the value of ADJ. R2, which is generally higher than 0.5. In Table 7 above, the value is 0.855604, higher than 0.5.

Table 7. Model construction.

Variables	VAR
Y (−1)	0.400844
	−0.55874
	[0.71741]
Y (−2)	−0.107309
	−0.45696
	[−0.23483]
X (−1)	0.012026
	−0.12609
	[0.09537]
X (−2)	0.113532
	−0.17941
	[0.63281]
DIS (−1)	0.087966
	−0.21172
	[0.41548]
DIS (−2)	−0.03003
	−0.12378
	[−0.24260]
CROPS (−1)	−1.148005
	−1.62367
	[−0.70704]
CROPS (−2)	−1.00701
	−1.76262
	[−0.57132]
TOTAL_SOWN (−1)	0.827295
	−1.19567
	[0.69191]
TOTAL_SOWN (−2)	0.701732
	−1.28563
	[0.54583]
C	−1638.112
	−1828.13
	[−0.89606]
R-squared	0.945852
Adj. R-squared	0.855604
Sum sq. resides	102593.7
S.E. equation	130.7629
F-statistic	10.48066
Log likelihood	−98.11716
Akaike AIC	12.83731
Schwarz SC	13.37645
Mean dependent	634.0676
S.D. dependent	344.118

According to the above VAR model values, the influence of X on Y is positive, that is, the higher the value of X, the higher the value of Y.

4.5. Stability Test

4.5.1. AR Root

The stability test in Figure 1 intuitively shows that its values are below value one. Combined with Table 8 below, the modes of all lag roots of the VAR model are less than one, indicating that the VAR (2) model is relatively stable. Thus, it shows that the influence relationship between X and Y is objective.

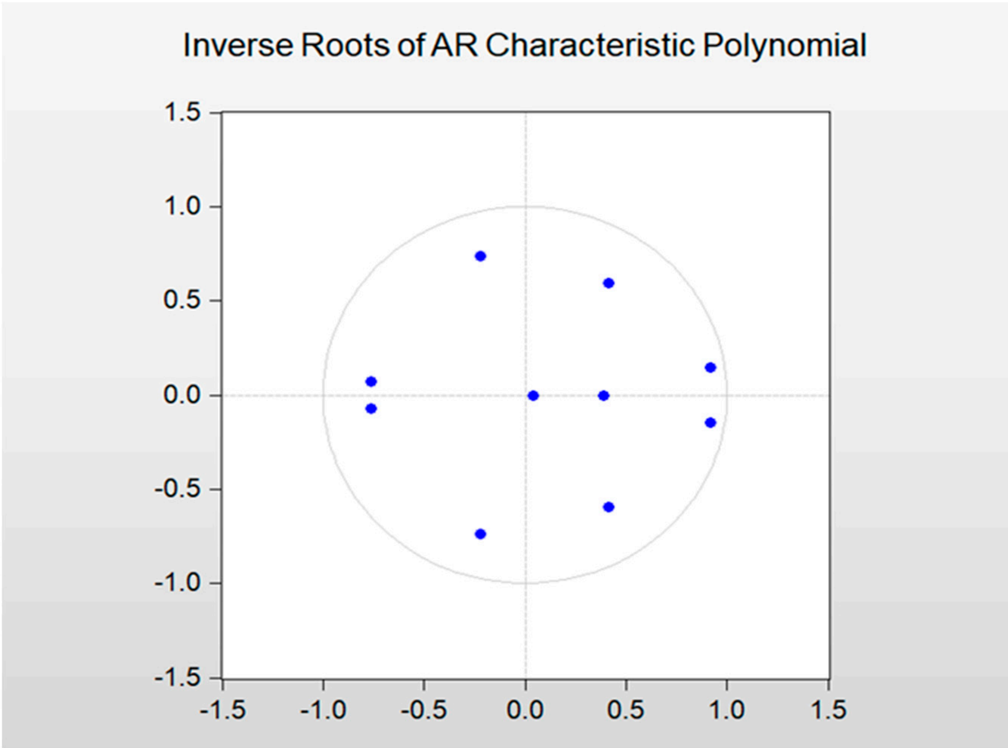

Figure 1. Stability test chart.

Table 8. Lag root test.

Root	Modulus
0.916799 − 0.147196i	0.92854
0.916799 + 0.147196i	0.92854
−0.223086 − 0.738654i	0.771607
−0.223086 + 0.738654i	0.771607
−0.759682 − 0.071933i	0.76308
−0.759682 + 0.071933i	0.76308
0.413699 − 0.595581i	0.725165
0.413699 + 0.595581i	0.725165
0.390255	0.390255
0.038399	0.038399

i in the root of the unit is the imaginary number of units.

4.5.2. Impulse Response Function Analysis

Through the above demonstration and analysis, we can see the long-term cointegration relationship between the application level of the green development concept and farmers' income, however, it cannot reflect the dynamic connection between the two. The analysis of the impulse response function shows the degree to which a variable reacts to an impact of one standard deviation in different periods in the future. The impulse response is usually the output of the system when the input is the unit impact function. The impulse response analysis made by the impulse response can reflect the dynamic relationship between the explanatory variables and the explained variables for a long time.

As shown in Figure 2, this figure represents the response function graph of farmers' income and grain output after being pulsed by the application level of the green development concept and themselves. The dashed line in the figure reflects the confidence region within one standard deviation, while the solid line represents the corresponding impulse function value. The abscissa represents the number of lag periods set. In this study, according to the figure, the actual impulse response number to be set is 10 periods. The ordinate represents the dynamic sensitivity of farmers' income and grain yield (explained variables) to pulses of different variables. As shown in Figure 2, when X gives Y a positive shock, Y will immediately produce gentle, positive feedback, which reaches the peak in the fourth period, then gradually decreases, and becomes negative in the seventh period. Subsequently, it slowly converges to zero. This pulse diagram indicates that X has a long-term promoting influence on Y, however, it has a negative influence after reaching the seventh period, which means that in the long run, the larger the value of X, the smaller Y will be. When substituted into the explanatory and explained variables, it means that, in the long run, the more fertilizer, pesticide, plastic film, and agricultural diesel are used, the less grain will be produced, and the less income farmers will have.

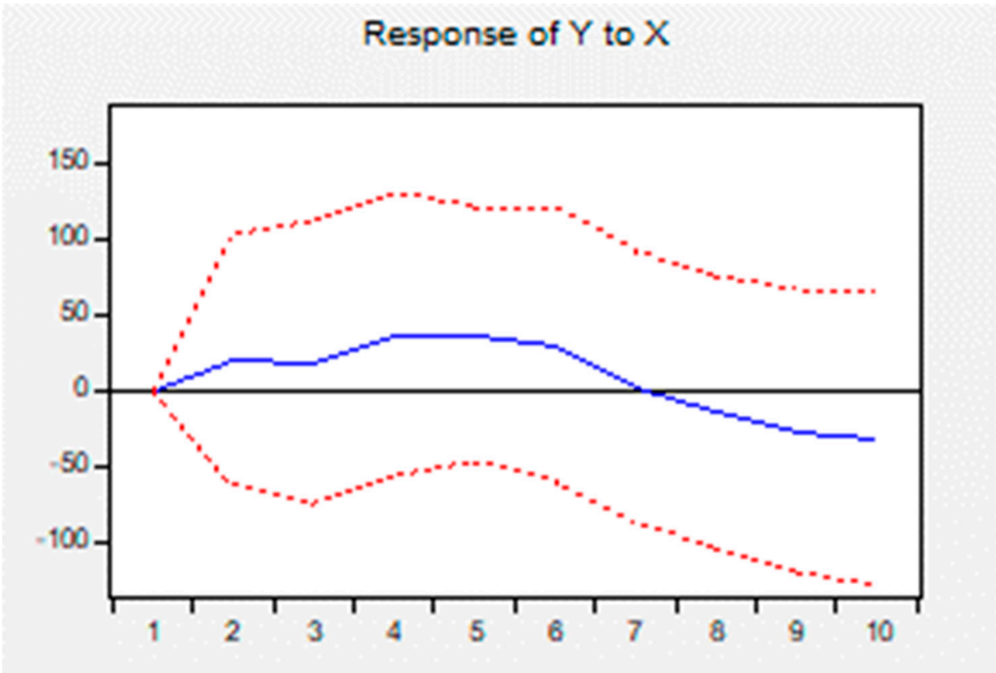

Figure 2. Impulse responses of explanatory variables to shocks of explained variables. The red line (dashed line) reflects the confidence region within double the standard deviation. The blue line (solid line) represents the corresponding impulse function value.

In addition, control variables are taken as influencing factors to analyze their influence on the explained variables over a long period.

The pulse meaning reflected in Figure 3 means that the affected area will have a negative impact on farmers' income and grain output in the early stage, reach a peak in the third period, and then turn to a positive impact. As an impulse response, it is generally in the back to make the graph converge to the middle, and the central axis is the impact. Therefore, the actual pulse graph is not good, and its effect does not converge. It should belong to a variable with no effect, that is, after many years, the affected area will not have an impact on the explained variable.

Figure 4 shows that the total sown area of crops to the farmers' income and food production, first of all, will produce a positive effect. That is to say, the planting area is larger and the farmers' income and grain yield are higher, then the influence gradually levels off in the third period, with the influence of the variable falling slowly since eventually tends to zero. In the long run, the total sown area of crops has no direct effect on farmers' income and grain yield.

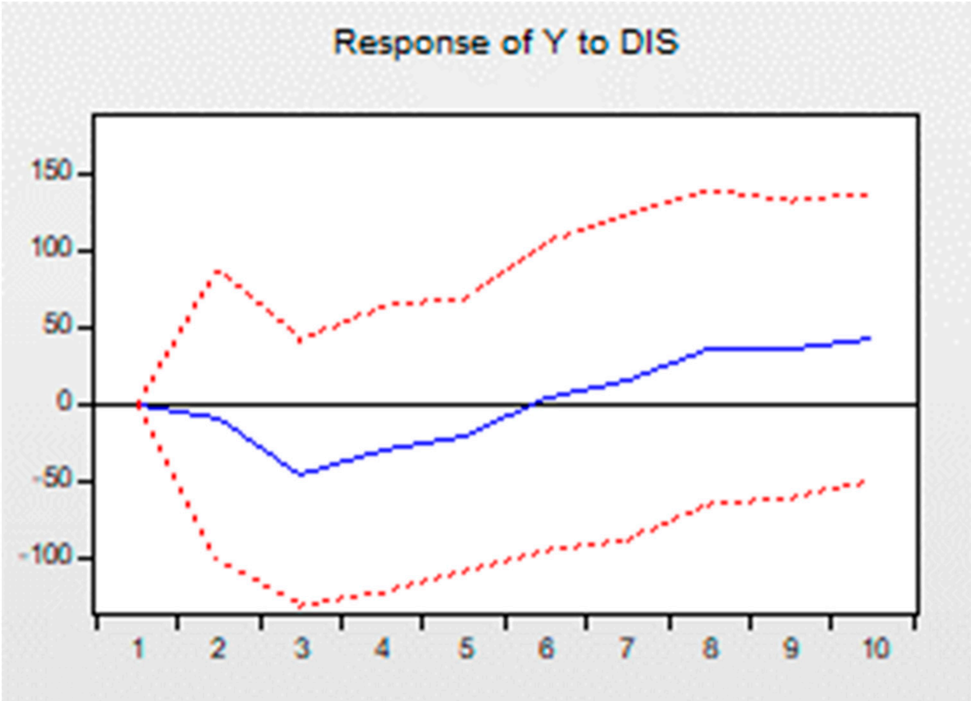

Figure 3. Impulse response of the affected area to the impact of the explained variable. The red line (dashed line) reflects the confidence region within double the standard deviation. The blue line (solid line) represents the corresponding impulse function value.

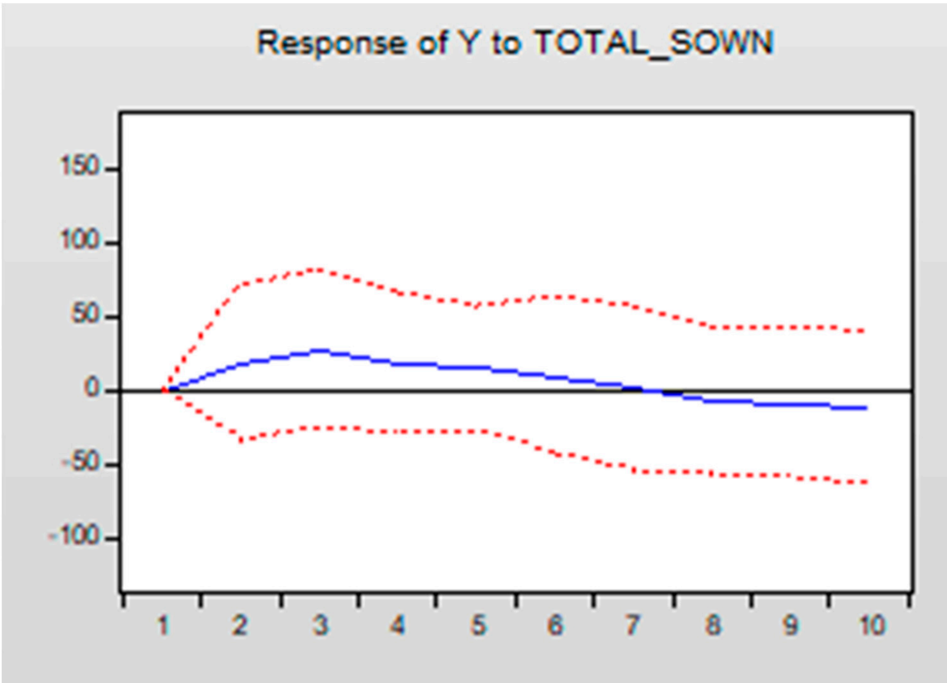

Figure 4. Impulse response of the total sown area of crops to the shock of the explained variable. The red line (dashed line) reflects the confidence region within double the standard deviation. The blue line (solid line) represents the corresponding impulse function value.

As shown in Figure 5, the effect of sown area of grain crops on farmers' income and grain output has always been small, and the influence is insignificant in the long and short term.

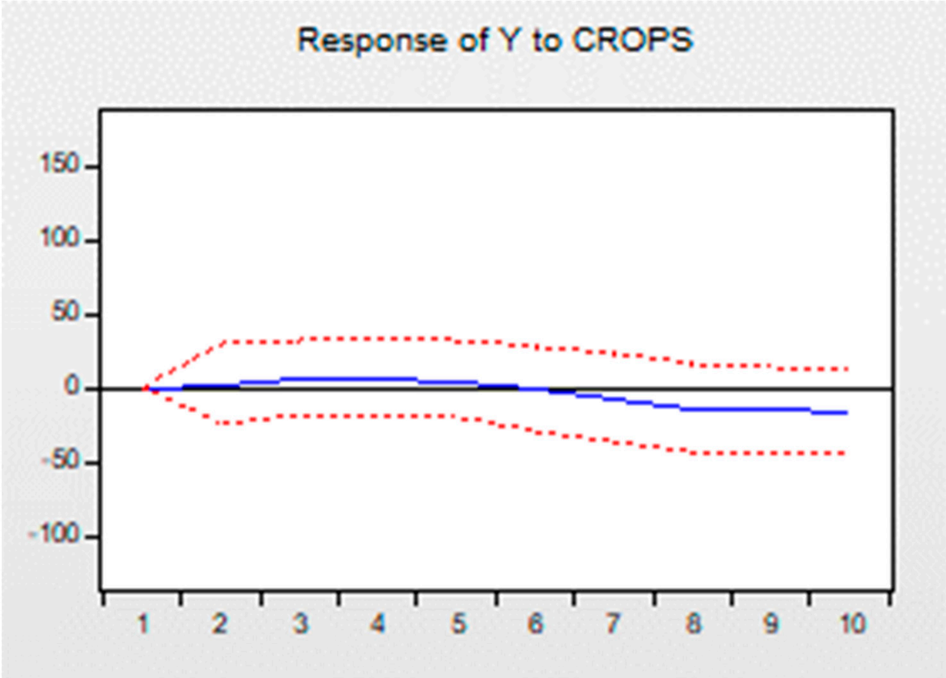

Figure 5. Impulse response of sown area of grain crops to the impact of explained variables. The red line (dashed line) reflects the confidence region within double the standard deviation. The blue line (solid line) represents the corresponding impulse function value.

The argument for the interconnection between green development and green governance encompasses empirical evidence of the positive functions of green development applied to agricultural production and how to roll out green governance strategies in a comprehensive manner. Based on the theoretical framework of development communication, the modernization of governance approaches is closely linked to the integration of new media. The new media is crucial to the dissemination of governance information, and thus the collaborative approach to modernizing green governance can be attributed to the category of communication. "Communication for development" is the core idea of development communication theory, and this theoretical point is in line with the collaborative and mutual construction of "green governance for green development" in this study. From the implementation of the concept of green development to the formation of green governance strategies, governance as a platform demonstrates a mutually adaptive and mutually supportive relationship.

The series of arguments on the interconstructive relationship between green development and green governance is in fact a return to the scope of "green development" on rural governance—the "green governance of the countryside". The logical endpoint of the interconnection is the content paradigm of green governance in the countryside. New media play a modernizing role in transparency and integrity in government. New media in rural green governance can be translated into a practical study of green production, green living, and ecoenvironmental construction and governance.

5. Discussion

This study measured the application level of the green development concept in Guangdong province in the past 20 years by the entropy method. Based on establishing the VAR time series model, this study uses the ADF unit root test, cointegration test, Granger causality test, impulse response function, and other research methods to make an empirical analysis of the impact of the application level of the green development concept on farmers' income and grain production in Guangdong Province. According to the above research data, the analysis results are as follows.

First, green development needs to be promoted vigorously. The application of the green development concept in agricultural production in Guangdong has a causal relationship with the two-way granger relationship between farmer income and food production. While promoting the spread and application of the concept of green development in practice in Guangdong Province, it is necessary to promote the increase of farmers' income through high value-added organic food and other green products. While increasing farmers' income, we will pay more attention to the green development of agriculture and increase the proportion of green development concepts applied in agricultural production.

Second, for a long time in the past, chemical fertilizers and pesticides have played a role in promoting the development of agricultural production. From the conclusion of VAR model construction, X has a positive impact on Y, which means in agricultural production the greater the use of pesticides, chemical fertilizers, plastic film, and agricultural diesel. The higher the farmers' income, the higher grain production can be increased. This conclusion shows that the larger the value of X, the larger the value of Y in the last two decades.

In the development of agricultural production in China, the use of chemical fertilizers in agricultural use plays an important role in the production income of farmers. Pesticides, fertilizers, plastic membranes, and agricultural diesel fuel are effective measures to help farmers get rid of pests and diseases in food processing plants and to protect against frost and drought. Before the 12th Five-Year Plan, the Chinese government's requirements for rural development focused on improving production capacity, promoting rapid rural development, and narrowing the gap between urban and rural areas. During the period of rural development, the use of chemical fertilizers increased farmers' income [43]. However, with the popularization and abuse of pesticides and fertilizers, the agricultural development mode of blindly increasing production while ignoring the ecological environment is not in line with the development law of "metabolism" [44]. Pesticides and fertilizers have caused ecological crises caused by soil pollution [45]. In fact, for a long time in the past, the use of chemical fertilizers, pesticides, mulch, and agricultural diesel oil is indeed a powerful means to promote farmers' income and production.

Third, in the long run, the greater the use of chemical fertilizers and pesticides will reduce farmers' incomes. The impulse response figure was positive to the influence of the early stage of X in Y, but after seven nodes, it explains the influence of variable X. Variable Y becomes negative, indicating that, in the long run, such fertilizer usage increase will reduce the farmers' income and food production. On the contrary, less fertilizer used would lead to increasing farmers' income and food production. This empirical result shows that in the subsequent development of agricultural production, the use of pesticides, fertilizers, plastic film, and agricultural diesel should be gradually reduced, and the concept of green development should be gradually spread, accepted, and applied to develop ecological agriculture and adhere to the road of sustainable development.

At present, Guangdong has gradually tried the green development mode in the development of ecological agriculture, such as contracted farms and mechanized operations. No fertilization or pesticide use leads to a decline in grain yield per mu, but green production mode produces high-quality organic grain and increases the added value of the grain. [46]. From the empirical analysis of the content graph based on the impulse response, the application of a highly green development concept will effectively promote farmers' income and food production in the long run. The high-added value of green products improves farmers' living standards. The transmission and sharing of the concept of green development will effectively improve the practical ability of green development in rural areas and improve the efficiency of solving the problems of developing agriculture, rural areas, and farmers in China.

In addition, starting from the need to transform green development to green governance, this chapter uses indepth interviews to provide a comprehensive explanation of the development of ecological agriculture in Guangdong, to provide a relatively strong account of the "evolution from green development concepts to green governance strategies". An indepth survey of local farmers reveals that digital farming will focus on guiding mechanized operations, reducing the use of fertilizers and pesticides, and resulting in lower yields per acre for farmers. However, the overall income of farmers has increased, with farmers now earning around 70,000 to 80,000 a year, all from selling organic food. The countryside is the backyard of the city and a support point for urbanization, providing clean water, reassuring food, and fresh air, as well as other quality ecological products [47]. The position of the countryside in China's economic and social development should not be underestimated. To promote the green transformation of China's economy and society, the green transformation of rural governance is indispensable. After the introduction of pesticides into agricultural production, they have indeed contributed to an extremely rapid increase in agricultural production and safeguarded farmers' living standards over the course of more than a century of development. At the same time, production pollution has become one of the objects of the ecologists' crusade, and the development of green production in agriculture is worthy of an indepth discussion in both China and the West [48]. In the long run, the reduction of pesticides and fertilizers will further enhance the productivity and economic efficiency of agricultural production, thus ensuring a low-carbon and green ecological environment.

6. Conclusions

This research focuses on understanding agricultural knowledge and information from a professional perspective, including the agricultural knowledge production system, transformation system, and user application system. The study found that while the initial focus was on technologists throughout the agricultural communication system, the improved model focused on "farmers". The adoption of the green development concept has a positive impact on farmers' income and grain growth. The essence of development communication is the sharing of knowledge and information, and the core of agricultural communication is the dissemination of agriculture-related knowledge and information. Based on the above empirical research, from the perspective of sustainable development, green development will promote farmers' income and rural development in the process of rural modernization. The implementation of the concept of green development is particularly important, and the actual transformation of the concept of green development is that the country adopts green management in governance. In the discourse practice of green development, domestic sewage treatment, ecological environment improvement, and other relevant measures are the manifestations of green governance in rural areas, reflecting the necessity of transforming from green development to green governance. The limitations of the study are mainly reflected in the relatively homogeneous selection of data. The data are mainly based on the data from Guangdong province, future studies could be expanded to cover multiple provinces across China.

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