

# Analysis of Factors Affecting Grain Produces in Henan Province

Yinglong Yue

Zhengzhou University of Aeronautics School of Economics Henan Zhengzhou 450046, China

**Abstract:** As an important grain producing area of my country, Henan is important for impacting the influencing factors behind my country's grain production and optimizing industrial policies. This paper uses the main component analysis method to conduct an empirical analysis, studying the relationship between grain production in Henan Province and area of cultivated land, total power of agricultural machinery, irrigated area, consumption of chemical fertilizer by 100% effective component, electricity consumption in rural areas, diesel oil use for agriculture, consumption of chemical pesticides, plastic film uses for agriculture, mulch area and total output of meat. The study found: there is a large correlation between the various indicators in the indicator system; The comprehensive score of grain production in Henan Province is not increasing year by year.

**Keywords:** Grain production, Influencing factors, Index system, Main component analysis

## 1. Introduction

General Secretary Xi Jinping emphasized that it is necessary to stabilize food security when participating in the Second Conference of the 13th National People's Congress, Henan Delegation was considered. He clearly pointed out that "ensure that important agricultural products, especially grain supply, is the primary task of implementing rural resolution strategies," "Henan is a major agriculture province, especially grain production.

Henan Province is located in the middle and lower reaches of the Yellow River in the south of North China Plain. Most regions are in warm temperate, southern across subtropics. It belongs to the mainland season of the warm temperate transition of North Asia. At the same time, it also has the characteristics of the transition of the hilly mountain climate in the east to the plain and four quarters, the same period, complex and diverse and meteorological disasters. Since ancient times, it is an important granary.

Since the reform and opening up, grain production in Henan has increased from 20.974 million tons in 1978 to 68.258 million tons in 2020, an increase of 225.4%. While the sowing area increased from 10,966.7 thousand hectares in 1978 to 14741.61 thousand hectares of 2020, only 34.4%. In the case where the growth area growth in Henan Province is limited, it is necessary to achieve the growth of grain production, more of the growth of cultivated land unit production.

## 2. The Research Status Analysis

Always launched various research in terms of the influencing factors of my country's grain production. Cai Guili established an OLS multi-language regression model, through the model setting, estimation, inspection, adjustment, the main factors affecting my country's grain production and the relevant recommendations were proposed. Li Miao uses a co-integrated method to analyze the trend between grain production and various influencing factors and have a long-term and stable trend, and proposes measures for grain-increasing production by empirical analysis. Yu Zhenping pointed out the main factors affecting grain production in my country, and proposed the guarantee strategy for grain production in my country's grain production area, emphasizing that my country should strengthen the protection of grain producing areas. Zhou Jing et al. used the multi-returned model to illustrate the related relationships between interpretation variables selected and my country's grain production, and proposed an optimization path of my country's food production. Yin Shijie selected data such as grain production in Shandong Province, and analyzed the factors affecting grain production and used ARIMA model to predict grain production and influencing factors. Finally, the predicted data is gray-correlated, and the gray correlation between the front and rear the analysis results were compared, and at the same time, it

was predicted for the trend of grain production in Shandong Province. Wang Yan, etc. have drawn two main factors affecting the level of grain production in Anhui Province through factor analysis and principal component analysis. At the same time, it also pointed out the trend of changes in grain production capacity in Anhui Province.

In summary, the scholars have more research on grain production factors and have a wide range of studies, and their research results are reflected in theory and empirical levels. This paper is based on the existing research, multi-angle selection of influencing factors to build an index system. Through the main component analysis method. This paper calculates the comprehensive score of various indicators in Henan Province and conducts in-depth analysis based on the results, providing theoretical basis for the development of corresponding policies, which is conducive to further promoting stable growth in grain production.

### 3. Data Selection

This article selects grain production in Henan Province from 2000 to 2019 as a research object, the data of the evaluation index system is from "2021 Henan Statistical Yearbook". On the basis of combining Li Xinhui et al., according to the integrity and data availability of information, this paper selects 10 representative indicators from the four levels of land use, production technology, production resources, and resource species, which are: area of cultivated land( $x_1$ ), total power of agricultural machinery( $x_2$ ), irrigated area( $x_3$ ), consumption of chemical fertilizer by 100% effective component( $x_4$ ), electricity consumption in rural areas( $x_5$ ), diesel oil use for agriculture( $x_6$ ), consumption of chemical pesticides( $x_7$ ), plastic film uses for agriculture( $x_8$ ), mulch area( $x_9$ ) and total output of meat( $x_{10}$ ).

It should be noted: the sowing area contains grain, cotton, oil and others; the meat production includes pork, beef, lamb, poultry and other; the data in 2013 and previous years is the effective irrigation area of farmland; the data after 2016 will no longer include agricultural transport vehicles and three-wheeled transport vehicles.

### 4. Model Selection

Main component analysis is introduced by Pearson to non-random variables in 1901. The main purpose of the main component analysis is to explain most of the variation of the original data with less variables. It can be seen that the main component analysis is actually a reduction method.

The steps of evaluating the main component analysis method are as follows:

1) Standardization for raw data

Convert the indicator value  $a_{ij}$  to a standardized indicator  $\tilde{a}_{ij}$ , as follows:

$$\tilde{a}_{ij} = \frac{a_{ij} - \mu_j}{s_j}, (i=1, 2, \dots, n; j=1, 2, \dots, m)$$

2) Calculating the correlation coefficient matrix R

Related coefficient matrix  $R=(r_{ij})_{mm}$ ,  $r_{ij} = \frac{\sum_{k=1}^n \tilde{a}_{ki} \cdot \tilde{a}_{kj}}{n-1}$ ,  $(i, j=1, 2, \dots, m)$ .

3) Calculating features and feature vectors

The features contain  $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_m \geq 0$ , and its corresponding feature vectors contain  $u_1, u_2, \dots, u_m$ ,  $u_j = (u_{1j}, u_{2j}, \dots, u_{mj})^T$ .

$$\begin{cases} y_1 &= u_{11}\tilde{x}_1 + u_{21}\tilde{x}_2 + \dots + u_{m1}\tilde{x}_m \\ y_2 &= u_{12}\tilde{x}_1 + u_{22}\tilde{x}_2 + \dots + u_{m2}\tilde{x}_m \\ \dots &\dots \dots \dots \dots \dots \dots \dots \dots \dots \\ y_m &= u_{1m}\tilde{x}_1 + u_{2m}\tilde{x}_2 + \dots + u_{mm}\tilde{x}_m \end{cases}$$

$y_1$  is the first principal component,  $y_2$  is the second principal component,  $y_m$  is also like this.

4) Computing comprehensive evaluation value

Firstly, the information contribution rate and accumulation contribution rate of the characteristic value  $\lambda_j (j=1,2,\dots,m)$  are calculated.

Secondly, computing integrated score

$$Z = \sum_{j=1}^p b_j y_j$$

Thirdly, evaluation can be evaluated according to the integrated score.

**5. Empirical Analysis**

This article uses SPSS 26 software to analyze the selected data. In order to verify whether the data is suitable for the main component analysis, this article performs KMO testing and Bartlett spherical testing on the data analysis of main components. The data of the main component analysis and the Bartlett spherical test are shown in table 1, and the KMO is 0.817, greater than 0.8, and the significance is less than 0.05, indicating the data support main component analyze.

*Table 1: KMO Test and Bartlett Test*

KMO	0.817
Bartlett test	442.041
df	45
Sig	0.000

The total variance interpretation table of 10 statistical variables is calculated, that is, table 2. Table 2 lists the main components characteristic values of the data output, namely the difference contribution rate and the accumulated contribution rate. Depending on the characteristic value greater than 1, the cumulative contribution rate is greater than 85%, a main component can be extracted, and the corresponding feature value is 8.507. The accumulated contribution rate of the variance reaches 85.069%, which can replace all the influencing factors, and lost information is negligible.

*Table 2: Interpretation of the Total Variance*

Ingredient	Initial feature value			Extract the sum squares		
	Total	Various percentage	Accumulated percentage	Total	Various percentage	Accumulated percentage
$x_1$	8.507	85.069	85.069	8.507	85.069	85.069
$x_2$	0.724	7.243	92.311			
$x_3$	0.524	5.239	97.551			
$x_4$	0.115	1.154	98.705			
$x_5$	0.061	0.606	99.310			
$x_6$	0.039	0.394	99.704			
$x_7$	0.022	0.222	99.926			
$x_8$	0.005	0.050	99.976			
$x_9$	0.002	0.017	99.993			
$x_{10}$	0.001	0.007	100			

After determining the main component, only the load matrix of the main component is required, as shown in table 3. The main component is represented by letter  $F_1$ , and it is shown below:

$$F_1 = 0.329x_1 + 0.336x_2 + 0.291x_3 + 0.341x_4 + 0.330x_5 + 0.335x_6 + 0.309x_7 + 0.338x_8 + 0.328x_9 + 0.198x_{10}$$

As can be seen from the above calculation results, there is a positive correlation between area of cultivated land, total power of agricultural machinery, irrigated area, consumption of chemical fertilizer by 100% effective component, electricity consumption in rural areas, diesel oil use for agriculture, consumption of chemical pesticides, plastic film uses for agriculture, mulch area and the food production, and the contact is close.

*Table 3: Ingredient Matrix*

Variable	Area of Cultivated Land (1 000 hectares)	Total Power of Agricultural Machinery (10 000 kw)	Irrigated Area (1 000 hectares)	Consumption of Chemical Fertilizer by 100% Effective Component (10 000 tons)	Electricity Consumption in Rural Areas (100 million kwh)
Main ingredient 1	0.960	0.980	0.849	0.996	0.962
Variable	Diesel Oil Use for Agriculture (10 000 tons)	Consumption of Chemical Pesticides (10 000 tons)	Plastic Film Use for Agriculture (10 000 tons)	Mulch Area (1 000hectare)	Total Output of Meat (10 000 tons)
Main ingredient 1	0.976	0.901	0.987	0.957	0.577

Finally, the composite score is as follows:

$$F=0.851*F_1$$

After entering the data, get the comprehensive score sheet shown below. That is table 4.

*Table 4: Integrated Scale*

Year	2019	2018	2017	2016	2015	2014	2013
Overall Ratings	9121.62	9116.41	9051.26	9045.51	9571.08	9415.59	9239.90
Year	2012	2011	2010	2009	2008	2007	2006
Overall Ratings	9145.58	9008.55	8877.90	8734.78	8625.08	8368.35	8111.49
Year	2005	2004	2003	2002	2001	2000	
Overall Ratings	7965.13	7781.14	7543.72	7326.21	7086.11	6955.23	

It can be seen from the above analysis, and the capacity of grain production in Henan Province has risen year by year from 2000 to 2011, from 6955.23 in 2000 to 9008.55 in 2011, has achieved a significant breakthrough. The comprehensive score from 2012 to 2015 continued to rise stable, and 9571.08 was reached in 2015. Down to 9045.41 in 2016, then gradually recovered.

## 6. Conclusions

Through the above studies, the results show that there is a significant positive correlation between the various indicators. Meat production is small relative to other indicators in the main component. The comprehensive score of grain production has not risen, and it has fallen in 2016, but it will gradually pick up. For the results of the research, the following suggestions are proposed:

1) The growth of area of cultivated land, total power of agricultural machinery, irrigated area, consumption of chemical fertilizer by 100% effective component, electricity consumption in rural areas, diesel oil use for agriculture, consumption of chemical pesticides, plastic film uses for agriculture, mulch area have played an important role in the increase in grain production in Henan Province, but its weight coefficient is small, indicating that these indicators have a difference in the role in grain boost production, so it should increase the investment of the above factors.

2) Agricultural plastic film has an important role in grain production and can be widely used. But at the same time, it will also cause certain damage to the environment, which can advocate agricultural plastic film reuse, or promote the use of degradable plastic films.

3) Livestock breeding has a certain impact on grain production, but the effect is not significant. In recent years, meat production has declined, so farmers can be encouraged with farming livestock, expanding the scale of industries, and encourages the management of family farms to increase farmers' income.

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