

*Original Research*

# Impact of Various Organic Fertilizers on the Growth, Yield, and Soil Environment of Peanuts Subjected to Continuous Cropping Obstacles

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## Abstract

To clarify the improvement effect of organic fertilizer application on peanut continuous cropping obstacles, a field plot experiment was conducted in a plot that had been continuously cropped with peanut for 5 years. Equal amounts of nitrogen were applied to the plot using charcoal-based fertilizer (T2), pig manure compost (T3), and chicken manure compost (T4), while chemical fertilizer (T1) and no fertilizer (CK) were used as controls. The study investigated peanut agronomic traits, yield and its contributing factors, soil physical and chemical properties, and peanut leaf diseases. The results showed that all three types of organic fertilizers could significantly promote peanut growth, with the T3 performing the best. The main stem height, length of the first lateral branch, and number of branches per plant in the T3 were 31.45%, 21.28%, and 26.32% higher than those in the CK, respectively. There was no significant difference between the T2 and T4 s in terms of main stem height and number of branches per plant compared to the T3. In terms of yield and its contributing factors, the performance of organic fertilizers was significantly better than that of the T1 and CK s. Among them, the T3 had the highest yield, which was 36.81% and 22.07% higher than that of the CK and T1 s, respectively. There was no significant difference between the T4 and the T3. The T2 and T4 s had the highest hundred-pod weight, while the T3 and T4 s had the lowest number of pods per kilogram. There was no significant difference in hundred-kernel weight among the three types of organic fertilizers. In terms of soil physical and chemical properties, the application of organic fertilizers significantly increased soil pH, porosity, field water holding capacity, and decreased soil bulk density compared to chemical fertilizer and no-fertilizer s. There was no significant difference in these indicators among the organic fertilizer s. In terms of soil

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nutrient content, all fertilization s significantly increased the content of total nitrogen, alkaline nitrogen, available phosphorus, and available potassium in the soil. Among them, the organic fertilizer treatments were significantly better than the chemical fertilizer in terms of total nitrogen and available phosphorus content. Additionally, organic fertilizer s significantly increased the soil organic carbon content, with the T2 having the highest organic carbon content, which was 20.56% higher than that of the CK. In terms of soil phenolic acid content, organic fertilizer s significantly reduced the content of vanillic acid and coumarin in the soil, with the lowest coumarin content observed in the T3 and T4 s. In terms of peanut leaf diseases, the disease index of peanut leaf spot and brown spot were significantly lower in the organic fertilizer s than in the no-fertilizer and chemical fertilizer s, but there was no significant difference between the different organic fertilizer s. After the comprehensive evaluation of the affiliation function method, it can be found that T4 can alleviate the continuous cropping obstacle to the greatest extent. The conclusion drawn from this study is that biochar-based fertilizer, pig manure compost, and chicken manure compost can all promote growth, increase yield, improve soil environmental quality, and provide certain disease prevention and control effects for peanut plants under continuous cropping obstacles. It is recommended to choose organic fertilizer for application in areas where peanut continuous cropping is more serious in a timely and site-specific manner.

**Keywords:** continuous cropping obstacles, organic fertilizers, peanut, phenolic acid, leaf disease

## Introduction

Peanut is one of the world's top five oil crops, and China has the largest peanut planting area in the world [1]. In 2021, China's peanut production was  $1.83 \times 10^7$  tons, with a planting area of  $4.81 \times 10^6$  hm<sup>2</sup> [2]. However, due to people's excessive pursuit of economic benefits in the peanut planting process, peanut continuous cropping has occurred frequently in recent years [3]. Continuous cropping obstacles severely affect the growth of peanuts, leading to the outbreak of diseases and a significant reduction in yield and quality. Continuous cropping obstacles in agricultural soils have four distinct properties. For starters, crop yields are declining. After producing the same crop for many years, the soil's nutrients diminish, resulting in lower agricultural yields. Second, pests and diseases are on the rise. Long-term cultivation of the same crop causes a progressive rise in pathogens and pests in the soil, increasing the crop's vulnerability to pests and diseases. Third, there is a lack of plant growth. Continuous cropping obstacles can cause an imbalance in the soil's microbiological and inter-root environment, restricting plant growth and development. Fourth, soil quality is deteriorating. Continuous cropping obstacles reduce the number of beneficial microorganisms in the soil and the looseness of the soil structure, resulting in a decline in soil quality. How to reduce the impact of continuous cropping obstacles in peanut production and achieve high yields is an important issue that urgently needs to be addressed in the industry. Existing research results show that the deterioration of soil physical and chemical properties and the self-toxicity of crops are important factors leading to continuous cropping obstacles [4] (Fig. 1). Regarding the former, the application of organic fertilizer can significantly improve soil properties, and its effect on increasing peanut yield is

better than rotation [5]. For the autotoxicity, current research has shown that beneficial microorganisms in the soil can effectively decompose phytotoxins, thereby reducing the adverse effects of autotoxicity on crops [6]. There is no conclusive research on whether organic fertilizers can alleviate the self-toxicity of peanuts, but organic fertilizers often contain a large number of beneficial microorganisms, which provides a possibility for organic fertilizers to alleviate self-toxicity. Continuous cropping obstacles often lead to aggravated crop diseases, and in order to prevent and control related diseases, producers have to use a large amount of pesticides, which undoubtedly increases the cost of agricultural production and may cause certain damage to the ecological environment [7]. It is generally believed that the application of organic fertilizers has a certain preventive and control effect on underground plant diseases. Scholars from Ningxia University used bio-organic fertilizers instead of nitrogen fertilizers for continuous-cropped watermelon and found that it had a significant control effect on watermelon wilt disease, and the incidence rate was only 14.82% [8]. For peanuts, the application of organic fertilizers also has a certain preventive and control effect on underground diseases such as white mold disease. During the preliminary study, it was found that the application of organic fertilizers in peanut fields resulted in a relatively lighter incidence of leaf diseases. This phenomenon prompted further considerations that organic fertilizers may also have a certain preventive and control effect on above-ground peanut diseases. Based on the above research, this paper aims to clarify the improvement effect of organic fertilizers on continuous cropping obstacles in peanut fields through a field plot experiment. Equal nitrogen levels of charcoal-based fertilizer, pig manure compost, and chicken manure compost were applied to a peanut field that had been continuously cropped

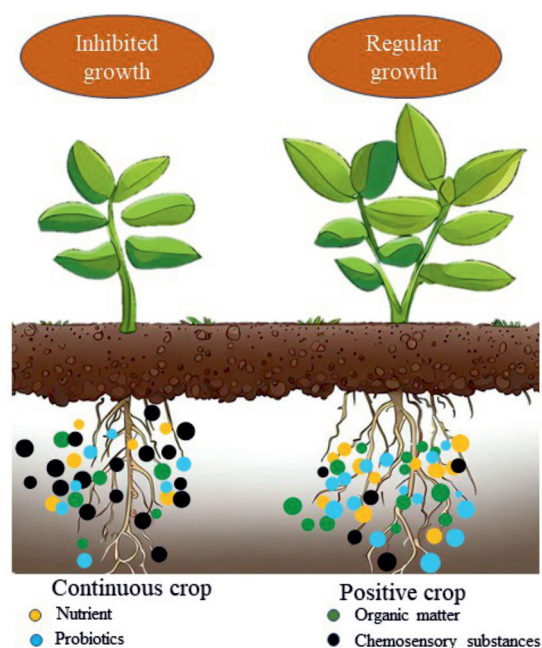


Fig. 1. Mechanisms of continuous crop obstacle.

for five years. A control group without fertilization and chemical fertilizer treatments were also included. The research focused on peanut agronomic traits, yield and its contributing factors, soil physicochemical properties, and peanut leaf diseases. The objective is to provide reliable scientific evidence for the reasonable fertilization of peanut production

### Experimental

#### Overview of the Test Site

The experiment was conducted from May 20, 2022 to September 19, 2022 at the Peanut Experimental Base of the Liaoning Academy of Agricultural Sciences. The test site is in the Liaohe River basin in Shenyang, Liaoning Province, and has an average annual temperature of 6.9°C, a maximum temperature of 36.5°C, a minimum temperature of -29.9°C, an average annual sunshine duration of 2867.8 h, a frost-free period of 150 days, a cumulative temperature above 10°C of

3283.3°C, and an annual precipitation of 540 mm. The test site’s soil is a sandy loam with a sandy texture that leaks fertilizer and water and is deficient in nutrients. In the northwest of Liaoning, it is a significant soil type for agricultural output. It is flat and sunny, with simple access to drainage and irrigation.

#### Materials

The peanut variety used in this study was ‘Guangdong Oil 7’, provided by the Crop Research Institute of Guangdong Academy of Agricultural Sciences. The organic fertilizers used in the experiment were charcoal-based fertilizer, chicken manure compost, and pig manure compost, all purchased from local agricultural input dealers. The chemical fertilizers used in the experiment were purchased from Jiangsu Huachang Chemical Co., Ltd.

#### Methods

The peanut planting density was  $1.50 \times 10^5$  holes per hectare, and the planting was conducted in double rows on large ridges with a spacing of 15 cm between plants within a row and 15 holes per ridge, with 2 plants per hole. The seeds were sown on May 20, 2022 and harvested on September 19 of the same year. Five s were set up: no fertilizer application (CK), chemical fertilizer application (T1), application of charcoal-based fertilizer (T2), application of pig manure compost (T3), and application of chicken manure compost (T4). Each treatment was replicated three times, with a total of 15 plots of 27 m<sup>2</sup> each. The fertilizers used for each treatment were applied as basal fertilizer in a one-time application before sowing, based on the same nitrogen content, and were carefully managed during the growth period. The nutrient content and application rates of the fertilizers used in the experiment are detailed in Table 1.

#### Measurement Items

##### Survey of Disease Incidence

At peanut maturity, a review of foliar diseases, such as peanut brown spot and peanut web spot,

Table 1. Nutrient content and application rate of the test fertilizer.

	Fertilizer nutrient content /%			Nutrient content applied /(kg·hm <sup>2</sup> )			Fertilizer application rate /(kg·hm <sup>2</sup> )
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
CK	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T1	16.00	12.00	17.00	60.00	45.00	63.75	375.00
T2	1.80	1.50	1.40	60.00	50.00	46.66	3333.33
T3	2.91	1.17	2.14	60.00	24.12	44.12	2061.86
T4	3.20	0.22	1.32	60.00	4.13	24.75	1875.00

Table 2. Grading criteria for leaf diseases of peanuts [9].

Disease scale	Disease description
0	No disease spots
1	Areas of disease spots<10%
2	Areas of disease spots<25%
3	Areas of disease spots<50%
4	Areas of disease spots<75%
5	Areas of disease spots≥75%

was conducted. (31 August 2022). The diagonal five-point method was used for the survey, with three plants being taken at each point for a total of 15 peanut plants per plot. According to the severity of the disease's occurrence, all of the leaves on the main stem of the peanut plant were examined. The disease was then divided into five classes. (Table 2). In the trial, researchers recorded the total number of leaves examined per peanut plant as well as the number of leaves affected by each disease class. These data were used to determine the corresponding disease index. The following is the formula for determining the disease index:

$$\text{Disease scale} = \frac{\sum A \times B}{C \times D}$$

Where, A represents the number of diseased leaves by condition class; B represents the representative grade values for each condition class; C represents the total number of leaves surveyed and D represents the highest disease level representative grade value.

#### *Survey of Agronomic Traits in Peanuts*

7 days before harvest, 10 peanut plants were randomly chosen from each plot to study agronomic traits such as main stem height, first lateral branch length, and number of branches per plant.

#### *Survey of Production and Its Components*

Surveys were conducted indoors to determine the number of pods per plant, kilograms of pods, the weight of 100 fruits, and the weight of 100 peanut kernels. Yield calculations were based on the quality of all air-dried pods in the plot after harvest.

#### *Soil Physicochemical Properties Determination*

The content of total nitrogen in the soil was determined using an elemental analyzer, the pH of the soil was determined using a pH meter and the soil bulk, porosity and field water holding capacity were determined using the ring knife method. The contents of total phosphorus, total potassium, alkaline

decomposed nitrogen, effective phosphorus, fast-acting potassium and organic carbon in the soil were determined separately with reference to the method of Liu [10]. The content of coumaric acid and coumarin in the soil was determined with reference to the method of Shao [11].

### Comprehensive Evaluation

The affiliation function was used to find the affiliation values for each of the indicators measured in the different fertilizers. The higher the affiliation value, the greater the degree of alleviation of the continuous cropping obstacles (negative indicators such as kilogram pod number, capacity, coumaric acid content, coumarin content and condition index are represented by the negative of the affiliation value), thus providing a comprehensive evaluation of the effect of different fertilizers on the alleviation of the continuous cropping obstacles. The affiliation values were calculated using the following formulae:

$$U(X_i) = \frac{X_{ij} - X_{j\min}}{X_{j\max} - X_{j\min}}$$

Where  $i$  represents treatments, and  $j$  represents measurement index;  $X_{ij}$  represents the value of  $j$  on  $i$ ;  $X_{j\max}$  represents the maximum value in  $j$ ;  $X_{j\min}$  represents the minimum value.

### Data Statistics and Analysis

Using DPS 18.1 software [12], the trial's raw data were submitted to one-way ANOVA after being tallied using Excel 2019. The images were drawn with Origin pro-2021.

## Results

### Agronomic Traits of Peanut

The application of organic fertilizers can improve the soil properties of continuously cropped soils, which can be reflected in the growth performance of plants. As shown in Table 3, the application of organic fertilizers significantly promoted the agronomic traits of peanut plants such as main stem height and the length of the first lateral branch, as compared to the unfertilized control (CK) and the chemical fertilizer (T1) ( $P<0.05$ ). All fertilization treatments significantly increased the number of branches per plant ( $P<0.05$ ), with the highest increase of 42.18% observed in the fertilization s relative to the CK. There was no significant difference observed among the organic fertilizer in terms of main stem height, while pig manure compost (T3) significantly outperformed the other organic fertilizers in terms of the length of the first lateral branch ( $P<0.05$ ), with increases of



Table 3. Effect of different organic fertilizers on agronomic traits of peanut.

	Main stem height/cm	First lateral branch length/cm	Number of branches per plant
CK	28.01±0.69c	32.57±0.41d	6.33±0.33b
T1	32.37±0.48b	34.73±0.51c	8.33±0.67a
T2	35.74±0.63a	37.09±0.40b	9.00±0.58a
T3	36.82±1.01a	39.50±0.38a	8.00±0.00a
T4	37.08±0.85a	38.09±0.32b	8.33±0.67a

Note: Differences between s are indicated by different letters ( $p<0.05$ ), same below.

21.28% and 13.73% relative to CK and T1, respectively. The application of organic fertilizers resulted in the highest increase of 32.38% and 14.55% in main stem height relative to CK and T1, respectively.

### Peanut Yield and Its Components

The ultimate goal of applying organic fertilizers in continuous cropping soil is to effectively improve crop yield and quality, with yield being the most important factor for farmers when using organic fertilizers. As shown in Table 4, organic fertilizer significantly increased peanut yield and its components compared with the CK ( $p<0.05$ ). Although T1 could increase peanut yield, it was still significantly lower than organic fertilizer. Among them, the T3 and chicken manure compost (T4) performed the best in terms of peanut yield, and there was no significant difference between the two treatments, with the highest increase of 36.81% and 22.07% relative to CK and T1, respectively. In terms of yield components, organic fertilizer did not show significant differences in terms of pods per plant and hundred-kernel weight. The charcoal-based fertilizer (T2) increased the number of pods per kilogram compared with T3 and T4, but there was no significant difference between T2 and T3. T4 and T2 performed best in terms of 100 nuts weight, with no significant difference between them and the highest increase of 9.02% and 5.00% relative to CK and T1, respectively.

### Soil Physicochemical Properties

In terms of soil physical properties (Fig. 2), the application of organic fertilizers significantly improved

soil capillary porosity, total porosity, and field water holding capacity, and significantly reduced soil bulk density compared to CK and T1 ( $p<0.05$ ). However, there was no significant difference in soil physical property indicators among the three organic fertilizers. The soil bulk density of T3 was the lowest among all s, with a value of  $1.34 \text{ g}\cdot\text{cm}^{-3}$ , which was 11.23% lower than that of CK (Fig. 2a). The capillary porosity of T2 was the highest, reaching 40.35%, which was 15.79% higher than that of CK (Fig. 2b). The total porosity of T3 was the highest, reaching 49.31%, which was 14.96% higher than that of CK (Fig. 2c). The field water holding capacity of T2 was the highest, reaching 29.67%, which was 28.85% higher than that of the CK.

In terms of soil chemical properties (Fig. 3), the application of chemical fertilizer reduced the soil pH (Fig. 3a), but there was no significant difference between the chemical fertilizer (CK) and the control group. The use of organic fertilizer significantly improved the soil pH ( $p<0.05$ ), but there was no significant difference among the three organic fertilizer, with T2 showing the highest pH value of 6.28 among all treatments. Additionally, the application of organic fertilizer increased the soil organic carbon content (Fig. 3b), with T2 having a significantly higher soil organic carbon content of  $9.30 \text{ g}\cdot\text{kg}^{-1}$  compared to other treatments ( $p<0.05$ ). T1 also increased the soil organic carbon content, but there was no significant difference between T1 and CK. T3 and T4 significantly increased the soil organic carbon content compared to CK and T1 ( $p<0.05$ ), but there was no significant difference between T3 and T4. Moreover, the application of organic fertilizer also had a significant impact on soil nutrient content. Specifically, the organic fertilizer showed higher content of total nitrogen (Fig. 3c) and

Table 4. Effect of different organic fertilizers on peanut yield and its components.

	Single plant pods number	Pods number/1000g	100 pods weight/g	100 nuts weight/g	Yield/667m <sup>2</sup>
CK	10.63±0.44c	652.37±4.79a	142.89±1.39d	87.33±0.88c	143.92±0.99d
T1	14.92±0.41b	619.79±2.06b	148.36±0.59c	98.67±1.25b	161.29±0.83c
T2	17.28±0.34a	591.08±1.61c	154.02±1.00ab	113.67±2.01a	190.12±1.41b
T3	17.84±0.31a	578.33±4.66cd	151.82±0.87b	114.00±2.51a	196.89±1.34a
T4	17.54±0.48a	576.24±6.74d	155.78±1.37a	111.33±2.40a	195.71±1.55a

available phosphorus (Fig. 3e) than chemical fertilizer. T3 achieved the maximum content of soil available nitrogen, showing an 11.48% increase compared to T1. There was no significant difference in available potassium content between T2, T3, and T1, but T4 showed the highest improvement, with a 16.17% increase compared to T1.

### Content of Coumaric Acid

Peanut autotoxicity is one of the important factors causing continuous cropping obstacles. The contents of vanillic acid and coumarin will increase with the increase of peanut continuous cropping years, which will inhibit the growth of peanuts and lead to more serious diseases. As shown in Fig. 4, the application of organic fertilizers significantly reduced the content

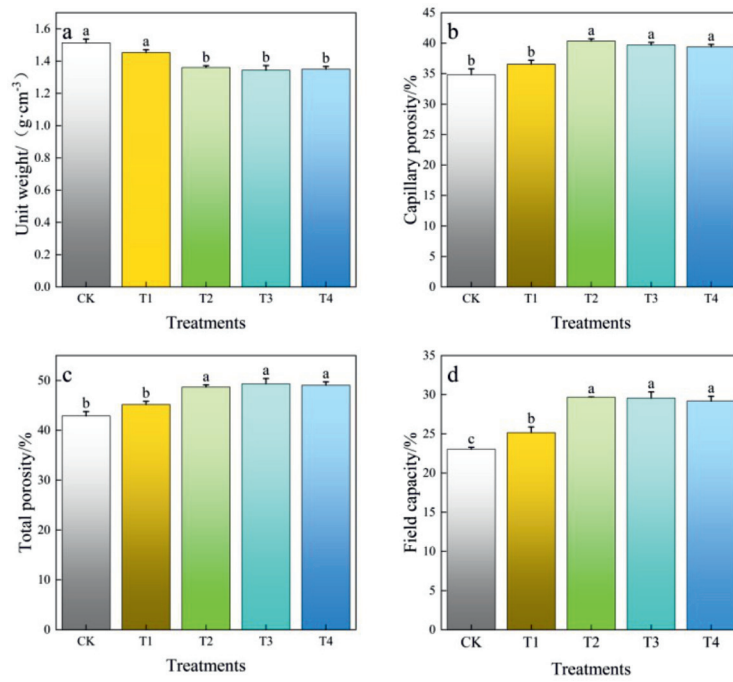


Fig. 2. Effect of different organic fertilizers on the physical properties of soils.

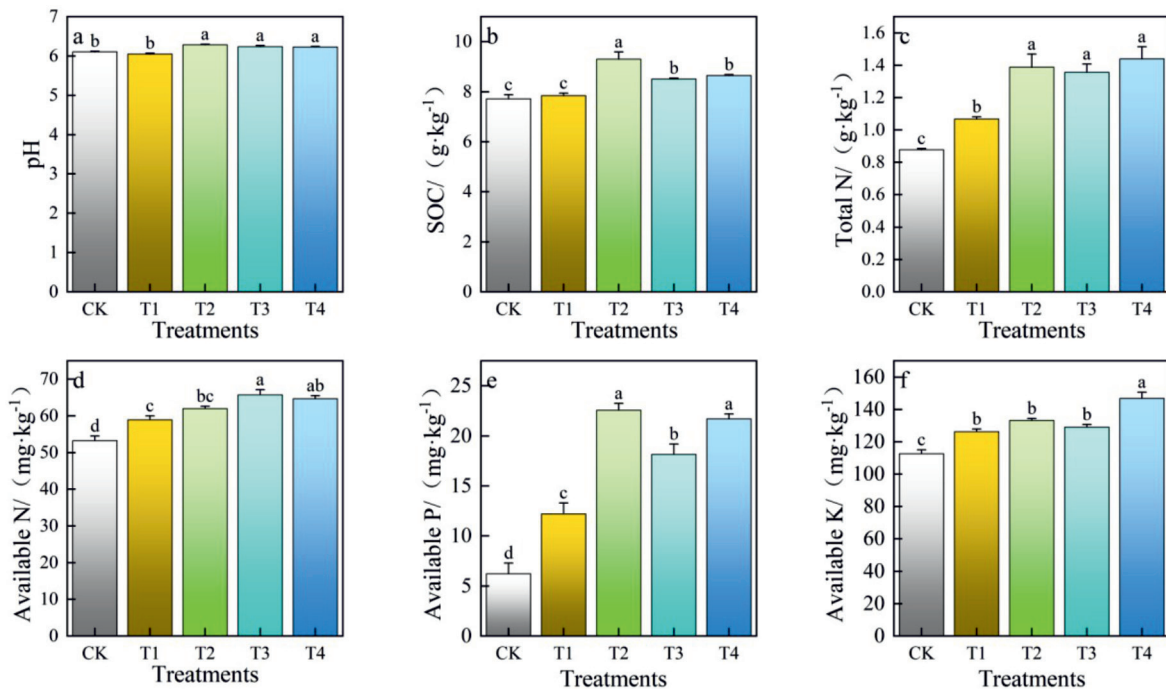


Fig. 3. Effect of different organic fertilizers on the chemical properties of soils.

of vanillic acid (Fig. 4a) and coumarin (Fig. 4b) in the soil ( $p<0.05$ ), indicating that the continuous cropping obstacles of peanuts were alleviated. There was no significant difference among the organic fertilizer s in terms of vanillic acid content, while the coumarin content in T2 was significantly higher than that in the other two organic fertilizer ( $p<0.05$ ).

### Leaf Disease

Improvement of soil physicochemical properties also has a positive effect on crop disease resistance. After the application of organic fertilizers, the disease index of peanut web blotch (Fig. 5a) and brown spot (Fig. 5b) showed a significant decreasing trend ( $p<0.05$ ), while there was no significant difference between T1 and CK. Compared with CK and T1, organic fertilizer can reduce the disease index of peanut web blotch by 31.68% and 30.61% respectively, and the disease index of peanut brown spot was reduced by 19.50% and 18.89%, respectively.

### Comprehensive Evaluation

The results of the aforementioned studies revealed a significant positive relationship between the use

Table 5. Comprehensive evaluation of the mitigation effect of continuous cropping obstacles.

	Average affiliation value			Rank
	Positive indicators	Negative indicators	Total	
CK	0.02	-1.00	-0.98	5
T1	0.37	-0.79	-0.42	4
T2	0.89	-0.13	0.76	2
T3	0.84	-0.079	0.76	2
T4	0.89	-0.05	0.84	1

of organic fertilizers and plant growth, yield, and soil physicochemical properties, suggesting that using organic fertilizers can lessen the impact of the continuous cropping obstacles. Based solely on these findings, it was challenging to compare the mitigating effects of the three organic fertilizers. It can be observed from Table 5 that T2 and T4 performed best in terms of positive indicators, and T4 performed best in terms of negative indicators, after we thoroughly evaluated each therapy using the affiliation function approach. T4 had the greatest mean affiliation value

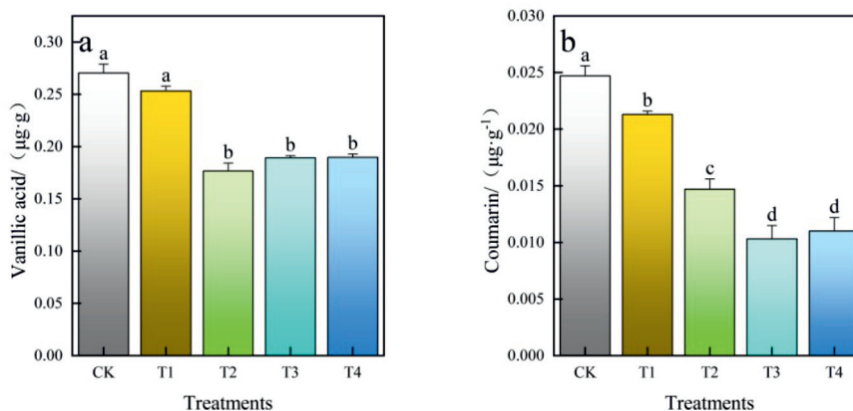


Fig. 4. Effect of different organic fertilizers on the content of phenolic acids in soil.

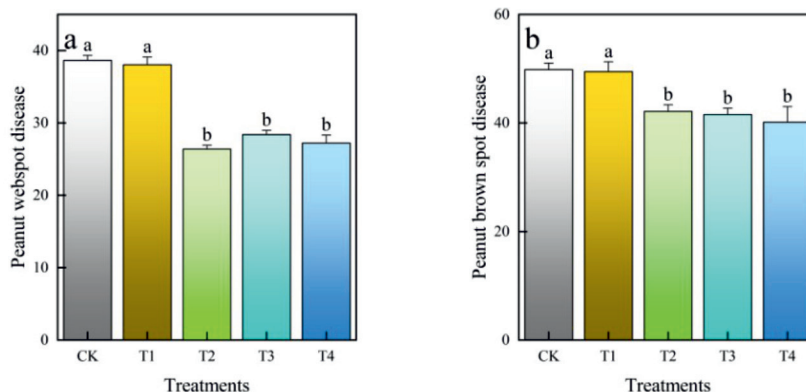


Fig. 5. Effect of different organic fertilizers on disease indices of peanut foliar diseases.

overall (0.84), followed by T2 and T3, all of which had mean affiliation values of 0.76, and T1 and CK, both of which had lower values (-0.42 and -0.98, respectively). These combined findings show that T4 had the best effect on soil continuous cropping obstacles in terms of relief.

## Discussion

Long-term continuous cropping is extremely prone to soil physicochemical deterioration, mainly manifested in soil acid-base imbalance, decreased content of available nutrients, and sharp decline in organic matter content [13]. Peanut is a crop that is particularly sensitive to continuous cropping. With the application of chemical fertilizers, a significant decrease in peanut yield can be observed after only 2 years of continuous cropping [9]. This study investigated the effects of three types of organic fertilizers on the soil environment of peanut continuous cropping from the aspects of soil pH value, nutrient content, organic carbon content, and phenolic acid content. The results showed that after applying the three organic fertilizers, the soil pH value was relatively improved compared with no fertilizer application and chemical fertilizer application, inhibiting the development of soil acidification. The reason for this was that the application of organic fertilizers increased the organic carbon content in the soil, promoting the growth of microorganisms that use organic acids as carbon sources, thereby increasing the soil pH value [14]. The promotion of soil organic carbon content by organic fertilizers was due to both the direct input of organic materials into the soil by organic fertilizers and the improvement of the overall soil environment, which increased the input of crop roots into the soil [15]. Regarding soil nutrient content, the application of organic fertilizers increased the content of total nitrogen, available nitrogen, available phosphorus, and available potassium in continuously cropped soil, which is consistent with the results of Gao's improvement of continuously cropped peanut soil with earthworm castings [16]. In addition, this study conducted preliminary research on the content of allelopathic substances in peanuts in soil. The results showed that the application of organic fertilizers significantly reduced the content of vanillic acid and coumarin in the soil relative to no fertilization and chemical fertilization. These two allelopathic substances have a strong inhibitory effect on the growth of peanut plants, especially vanillic acid. Tian et al. have proven through indoor pot experiments that vanillic acid has a significant inhibitory effect on the main root length, main stem length, branching number, and yield of peanuts, and seriously affects the absorption of nutrients by peanuts in the soil [17]. The application of organic fertilizers, which reduces the content of vanillic acid and coumarin in the soil, further confirms its improvement effect on continuously cropped soil. This may be

because the input of organic fertilizers increases the number of beneficial microbial populations in the soil, which accelerates the decomposition of allelochemicals. Whether organic fertilizers can directly regulate the process of peanut root secretion of allelochemicals needs further study.

Continuous cropping obstacles have varying degrees of impact on the agronomic traits of different crops, including soybean, maize, and peanut, which all show significant decreases in agronomic traits under continuous cropping conditions [18, 19]. Under equal nitrogen or nutrient content, the use of organic fertilizer can significantly improve the physical and chemical properties of the soil compared to chemical fertilizer, and the improvement of soil physical and chemical properties usually directly affects the good growth of plants, including the agronomic traits and disease occurrence of crops. In this study, agronomic traits such as plant height, length of the first lateral branch, and number of branches per plant were used as indicators of aboveground growth of peanut plants. The results showed that the application of organic fertilizer significantly promoted the growth of peanut plants. Compared to chemical fertilizers, especially compound fertilizers containing large amounts of nutrients, organic fertilizers contain more comprehensive nutrients needed for peanut growth, thus promoting peanut growth [20]. In addition, the application of organic fertilizers can also promote the formation of peanut root nodules, which significantly improve the yield and quality of peanut pods under continuous cropping conditions [21]. Compared with chemical fertilizers, especially compound fertilizers with abundant nutrients, organic fertilizers contain more comprehensive nutrient elements needed for peanut growth, thereby promoting peanut growth. In addition, the application of organic fertilizers can also promote the formation of peanut nodules, significantly improving the yield and quality of peanut pods under continuous cropping conditions. Among the three organic fertilizers used in this study, there was no significant difference in main stem height and number of branches per plant, but the application of pig manure compost showed a more significant promotion effect on the length of the first lateral branch of peanut plants compared to the other two organic fertilizers. In this study, each fertilization was applied with equal nitrogen input. The soil available nitrogen content under the pig manure compost was significantly higher than that under the other treatments, which may be one of the reasons for the significantly longest first lateral branch length of peanut plants under this. In addition, this study also focused on the effect of organic fertilizer application on foliar disease occurrence in peanuts. Although there is already a conclusion about the role of organic fertilizers in preventing and controlling plant diseases, current research mostly focuses on the effect of organic fertilizers on underground plant diseases, while there are few reports on the effect of organic



fertilizer application on aboveground plant diseases [22-24]. According to the research results of Huang et al. [9], the longer the continuous cropping years, the more serious the occurrence of leaf diseases in peanut. This is closely related to the deterioration of soil environment caused by continuous cropping, which leads to the decrease of soil pH and the decline of peanut plant resistance, making it susceptible to various diseases [25]. However, the application of organic fertilizer improves the quality of soil environment and provides comprehensive absorbable nutrients for peanut, which to a certain extent restores the resistance of peanut plants. This is also an important reason for the significant decrease in the disease index of peanut leaf spot and brown spot disease under organic fertilizer in this study. The soil environment of continuous cropping has been improved, and peanut plants have shown good growth, which has led to a significant increase in peanut yield. In this study, all organic fertilizers achieved a relatively high yield of peanuts, with pig manure compost showing the most significant increase, increasing by 36.81% and 22.07% compared to no fertilizer and chemical fertilizers, respectively. The application of organic fertilizers also had varying degrees of positive effects on yield components such as the number of pods per plant, hundred-pod weight, and hundred-kernel weight, which is consistent with the results of many studies on the effects of organic fertilizer application on crop yield in continuous cropping soil [26-28].

The following four key components make up the mechanisms of organic fertilizer to reduce crop succession barriers, according to the findings of this research and earlier relevant studies. enhancing soil structure is first [29]. By boosting soil porosity and cluster stability, improving soil permeability and air permeability, encouraging the reproduction of soil microorganisms and root growth, and enhancing soil permeability and air permeability, the organic matter in organic fertilizers can improve soil structure [30, 31]. Additionally, it offers a wider variety of nutrients. Because they are high in nutrients like nitrogen, phosphorus, and potassium, organic fertilizers can give plants the nutrients they require to meet their nutritional requirements for growth and development. By stabilizing the soil pH, the organic matter in organic fertilizers can control soil pH [32], minimizing the detrimental effects of soil continuous cropping obstacles on plants. Fourth, encourage microbial activity in the soil. The nutrients and energy needed for the growth and reproduction of soil microorganisms can be provided by the organic matter in organic fertilizer. This encourages soil microorganism activity, increases the types and numbers of soil microorganisms, improves soil biodiversity, and strengthens the soil's resistance to continuous cropping obstacles [30]. However, although organic fertilizer can improve the continuous cropping soil, we still need to adopt scientific application methods to achieve the best results. Before applying organic fertilizer, it is necessary to understand the texture, pH value, organic

matter content and other conditions of the soil in order to select the appropriate organic fertilizer variety and fertilizer amount. In addition, there are many types of organic fertilizer, such as livestock and poultry manure, manure, vegetable residue, straw, etc., different organic fertilizer components and nutrient content are different, and choosing the right type of organic fertilizer can improve the fertilization effect. There are many types of organic fertilizer, such as livestock and poultry manure, manure, vegetable residue, straw, etc., different organic fertilizer components and nutrient content are different, and choosing the right type of organic fertilizer can improve the fertilization effect. For fields without special ecological needs, organic fertilizer and chemical fertilizer can be combined with fertilization to complement each other and improve the fertilization effect. However, it is necessary to pay attention to the control of fertilization amount and fertilization time. In short, the rational application of organic fertilizer on continuous cropping soil needs to be comprehensively considered according to soil conditions, crop needs and organic fertilizer characteristics, and scientific fertilization can achieve the best fertilization effect.

## Conclusions

According to the results of this study, which investigated the application of organic fertilizers in continuous peanut fields from aspects such as peanut agronomic traits, yield and its composition factors, soil physical and chemical properties, and peanut foliar diseases, it was found that charcoal-based fertilizer, pig manure compost, and chicken manure compost all showed positive effects on promoting growth, increasing yield, improving soil environment quality and controlling diseases compared with no fertilizer and chemical fertilizer. Therefore, it is suggested that organic fertilizers should be applied in a timely and appropriate manner in regions where continuous cropping of peanuts is more severe.

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## Conflict of Interest

The authors declare no conflict of interest.

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