sustainability

MDPI

Article

Factors Influencing Farmers' Willingness and Behaviors in Organic Agriculture Development: An Empirical Analysis Based on Survey Data of Farmers in Anhui Province

Xiaohong Zhou [1,*] and Donghong Ding [2]

[1] School of Economics and Management, Anhui Sanlian University, Hefei 230601, China
[2] School of Management, University of Science and Technology of China, Hefei 230026, China
* Correspondence: ustczxh@ustc.edu; Tel.: +86-177-5516-5368

Abstract: Organic agriculture is currently the dominant method used for the sustainable development of modern agriculture. As the main component in agricultural production, farmers and their willingness and behaviors are important to the overall progress of the organic agriculture industry. Based on survey data from 306 farmers in the Anhui Province, we applied a bivariate probit model to analyze the relevant factors influencing farmers' willingness and behaviors in organic agriculture. The findings showed that a correlation existed between farmers' willingness to engage in organic agriculture and their behaviors. Factors such as farmer education level, political status, family disposable income, and their understanding of organic agriculture and environmental hazards considerably influenced the farmers' willingness to engage in organic agriculture. The variables of age, no-agricultural employment, and other factors played a substantial inhibitory role. This conclusion has certain value for further understanding of farmers' willingness to be engaged in organic agriculture and their behaviors and so contributed to the structural reform of the agricultural supply side and the implementation of the "Rural Revitalization" strategy.

Keywords: farmers; organic agriculture; willingness; behaviors; bivariate probit model

check for updates

Citation: Zhou, X.; Ding, D. Factors Influencing Farmers' Willingness and Behaviors in Organic Agriculture Development: An Empirical Analysis Based on Survey Data of Farmers in Anhui Province. *Sustainability* **2022**, *14*, 14945. https://doi.org/10.3390/su142214945

Academic Editor: Prashant Kaushik

Received: 4 October 2022
Accepted: 9 November 2022
Published: 11 November 2022

1. Introduction

Modern agriculture is dominated by "oil agriculture", where agricultural production efficiency is based on the plundering of ecological resources, thus breaking the original balance of the ecosystem and reducing biodiversity [1]. The deteriorating ecological environment has shown that "oil agriculture" cannot be adapted to the current move toward environmentally friendly agriculture [2]. Agrochemical products have been widely used in farming to effectively meet the needs for feeding and clothing people, but they have caused serious water and soil pollution, decreased the number of biological species, increased human cancer risk, and created other problems. China's arable land area only accounts for 9% of the world's total, but the country's use of chemical fertilizers accounts for 35% of the world's total; what is more, the absorption rate of chemical fertilizers is only 30% [3], while only 10–30% of pesticides are effectively absorbed by crops [3]. Therefore, the large number of chemical fertilizers and pesticides that are not absorbed by the land eventually enter the recycling system and become sources of pollution. The resistance of pests to pesticides is becoming increasingly stronger with their increased application, making killing pests more difficult. Environmental pollution leads to a substantial reduction in the number of natural enemies of pests, eventually forming a vicious circle and destroying biodiversity.

The excessive use of chemical fertilizers, pesticides, and additives in the agriculture industry, as well as the continued pollution of soil, water, and air, has pushed the issue of food safety to the forefront in China for decades. In 2012, the pollution of rice with excessive cadmium in Hunan was a warning of future potential hazards [4]. The consumption of agricultural products containing excessive pesticide residues and heavy metals from soil pollution both directly and indirectly endangers health over the long term and increases the rates of a wide range of acute and chronic diseases. The statistics show that the amount of fertilizers applied per hectare of land in China far exceeds international standards, thereby increasing production costs and resulting in lasting environmental pollution that poses a serious threat to public health and the ecological environment [5]. In 2020 alone, more than 912 thousand tons of pesticides were used in China, the main component of which was organ phosphorus, a highly toxic substance; however, at 38.9%, the pesticide use rate was far lower than that of many developed countries in Europe or the United States [6]. At present, more than 6 million hm^2 of arable land in China has been polluted to varying degrees by pesticide residue, which changes the properties of the soil, especially when chemicals with long periods of residual effect have been applied. For example, DDT (Dichlorodiphenyltrichloroethan) takes between 4 and 30 years to 90% dissipate in soil [7].

As environmental resources continue to shrink and food safety becomes an increasingly serious problem, organic agriculture has attracted the attention of both the government and farmers as a resource-saving, ecofriendly form of agricultural production. Many countries and regions are advocating the development of organic agriculture, which not only provides huge environmental and economic benefits but also protects the health of consumers and farmers. As an agricultural management mode closely related to the quality of the natural environment, organic agriculture is used not only to produce organic food but also to protect the natural environment [8]. Contrary to the serious decline in biodiversity caused by agricultural intensification, organic agriculture is conducive to the protection of and improvement in biodiversity. In general, the main advantage of organic agriculture is protecting the environment, being strongly adaptable to environmental change, increasing farmers' income, reducing external input costs, enhancing employment opportunities, and improving food security [9]. Based on sustainable development, organic agriculture can provide enough nutritious food for the world's population. As such, organic agriculture is becoming a rapidly developing economic field.

Increasing the scale of organic agricultural production is becoming of higher importance as a method to improve the income of producers, the ecological environment, and the level of food safety. For these reasons, opinions to accelerate the construction of an ecological civilization and other documents issued by China's State Council in 2015 have stressed the need to "develop green industries" [10]. In 2017, China's Ministry of Agriculture created an action plan to achieve zero growth in fertilizer use by 2020, proposing to vigorously promote the replacement of chemical fertilizer with organic alternatives, adapt science-based drug use, implement green prevention and control measures, encourage the comprehensive utilization of crop cultivation and livestock manure, and promote the development of ecological agriculture [11]. In 2020, China's "No. 1 Document" of the central government continued to emphasize the need to adjust and optimize the agricultural production structure, focus on strengthening the certification and management of organic agricultural products and agricultural products with geographical indications, and increase the supply of high-quality green agricultural products and organic food [12]. These documents and measures have served to promote the development of China's organic agriculture industry, though only to a certain extent.

However, due to various limitations, the development of organic agriculture in China still lags behind that in developed countries. Fundamentally, the development of organic agriculture lies in farmers; their willingness to engage in organic agriculture is especially key to farmers' adoption of organic agricultural production. Whether organic agriculture in China can reach a phase of rapid development largely depends on farmers' willingness and attitudes toward the new practices. Are farmers willing to engage in organic agriculture? What are the factors affecting their willingness to engage in organic agriculture and what concerns hinder farmers from engaging in organic agriculture? Therefore, the factors influencing farmers' willingness to engage in organic agricultural production and their behaviors have become the focus of research. In reality, farmers' willingness to adopt organic farming is constantly increasing, but the actual adoption rate is low. That is, willingness may not be able to be transformed into behavior. A large difference exists between intention and behavior [13]. What are the factors causing the inconsistency between farmers' willingness to grow organic agriculture and their behaviors? Clarifying the causes of the inconsistency between willingness and behavior provides important reference value for the promotion and application of organic production technology and even for the sustainable development of agriculture.

In this context, we focused on the relationship between farmers' willingness to engage in organic agriculture and their behavior, as well as the influencing factors. Based on the theory of planned behavior, we constructed hypotheses regarding the factors influencing farmers' willingness to engage in organic agriculture and their behavior from three perspectives: the basic characteristics of farmers and their families (including production and management characteristics) and understanding features. Using survey data from 306 farmers in six cities in the Anhui Province, we employed a bivariate probit model to empirically test the hypotheses and perform an analysis on the factors causing the inconsistency of farmers' willingness and behavior to adopt organic agriculture production. Additionally, we provide suggestions and countermeasures with the goal of promoting the development of organic agriculture on the basis of the model conclusions, so as to provide a reference for related departments to improve their policies for the advancement of the organic agriculture industry.

2. Literature Review

Since the advent of organic agriculture production techniques in the last century, the practices have received extensive attention. Scholars have fully examined organic farming from a variety of angles, such as the proposal and development of organic production methods, production willingness and technology adoption in organic agriculture, the development experience and policy comparison of organic agriculture, etc. Here, we describe the advanced achievements of organic agriculture with domestic scholars, so that the experience of other countries can aid with the development of organic agriculture in China.

2.1. Proposal and Development of Organic Agriculture

In 1911, the director of the U.S. Bureau of Agricultural Land Management, Franklin Hiram King, wrote "Four-thousand Years of Farmers", an exploration of China's long-standing experience with agriculture, which came to mark the formal genesis of modern organic agriculture. In 1940, organic agriculture appeared as a unique name in Walter Northbourne's article. In the 1940s, Rodale farm, in Pennsylvania, U.S., became the first fully organic farm in the world, globally kick-starting the development of organic agriculture [14]. Organic agriculture advocates for a harmonious coexistence between humans and nature, emphasizing agricultural production within the concept of an ecosystem and places heavy emphasis on the comprehensive use of resources and energy [15]. Chinese organic agriculture workers define the practice by following natural laws and ecological principles, coordinating a balance between planting and breeding, and refusing genetically engineered products or chemically synthesized agricultural drugs, fertilizers, growth regulators, feed additives, etc. This is an agricultural production mode that seeks to maintain a lasting and stable production system through the adoption of a series of sustainable agricultural technologies [16]. The International Federation of Organic Agriculture Movements further and accurately summarized the definition of organic agriculture as follows: organic agriculture includes all agricultural production systems that can promote the sound development of the environment, society, and economy to achieve the goal of producing the highest quality of agriculture and environment [17].

Another origin of organic agriculture is natural agriculture. In 1940, Albert Howard, a British botanist, wrote *An Agricultural Testament*, clarifying the relationship between soil protection and the growth of animals and plants, which became a model book that has inspired and guided the development of international organic agriculture [18]. In 1943, Eve

Balfour published *The Lively Soil*, which promoted the development of organic agriculture in Britain and the establishment of the British Soil Association in 1946, which has advocated returning organic matter to the soil to ensure the restoration of soil fertility and ecological balance [19]. Çalık said that organic agriculture emphasizes the protection and measured use of water and soil resources, seeking ecological balance and producing natural and safe agricultural products [20]. Singh stated that the advantages of organic agriculture include the conservation of soil and water resources and the efficient recycling of livestock waste [21]. Organic agriculture is not limited to the planting of crops but also pays special attention to the combination of vegetation and breeding as well as the rational allocation of agriculture, forestry, animal husbandry, and sideline fisheries. Different kinds of organic waste are reintroduced back into the agricultural production system, such as livestock manure, crop straw, and stubble, for recycling purposes and the overall reduction in waste products. Organic farming emphasizes the establishment of a sustainable agricultural production system: a "circular economy" model [22].

Some experts and scholars also found that organic agriculture has more development potential than conventional agriculture. Joachim Sauerborn, an organic agriculture expert in Australia, stated that organic agriculture is more efficient than conventional agriculture, and organic products are relatively beneficial to human health and the ecological environment [23]. From a data analysis report on China's organic agriculture in the 17th century, the planting industry in Jiaxing demonstrated that the reason why early Chinese farms were able to maintain high crop and soil yields was the implementation of organic agricultural methods [24]. Rahman said that using fewer chemical inputs than conventional agriculture is challenging, but still produced 80% of the output [25]. Ma de Oliveira, an expert from The Netherlands, found that organic cultivation methods can keep nutrients in the soil and help maintain soil health because chemical inputs are avoided, so crops can absorb more nutrients. As such, the relative yield is higher [26]. German organic agriculture expert Guilherme Felis found that organic agriculture is relatively more conducive to reducing energy consumption. For specific varieties, the results were more significant, such as organic cauliflower and organic chives [27]. Raynolds thought that the organic food market was rapidly developing and would become the fastest growing market in the world, which indicates the potential and space for the development of organic agriculture [28]. Chabert and Sarthou found that the scale of organic agriculture production was small and the production was gradually developing toward large-scale production. He showed that organic agriculture had a short history of development but will certainly develop for a long time in the future [29]. Relevant experts have predicted that organic agriculture will be the new direction of global agricultural development in the future and organic products will be the main consumer goods in the 21st century [30]. The development of organic agriculture can help to solve a series of environmental problems produced by modern agriculture, such as serious soil erosion, land quality decline, species diversity reduction, etc. Organic agriculture also plays a positive role in adjusting the industrial structure, increasing farmers' income, and ensuring food quality, so has become a potential superior industry [31].

2.2. Production Willingness and Technology Adoption in Organic Agriculture

According to the theory of planned behavior, conformity psychology, cognition, attitude, government regulation, and informal systems all impact farmers' willingness and behavior to engage in organic agriculture [32]. Utility theory, from neoclassical economics, holds that agricultural subsidies, government regulation, price factors, and brand premiums substantially affect agriculturalists' willingness and behavior toward organic agriculture production [33]. The results of an empirical analysis on the adoption of organic agricultural technology by British farmers showed that age, information access, and the number of household laborers had a significantly positive impact on the probability of adopting organic agricultural technology [34]. Muller reported that farmers' confidence in the successful use of technology, their expectation of net income, farm scale, and education all positively impacted the adoption of precision agriculture technology by farmers [35]. According to a study of farmers in Zhejiang Province, the per capita income, part-time nature, types of agricultural products, market sales, information channels, farmers' attitude toward risk, and other factors significantly affected the technology adoption behavior of farmers [36]. Godfray et al. found that risk especially had a significantly negative impact on farmers' adoption of organic agricultural technology [37]. In a survey of vegetable farmers in the Liaoning Province, the Heckman model was used to analyze the factors influencing farmers' adoption of sustainable production technology. The results showed that the education level of the household, total household income, planting area of household facilities, guidance of agricultural technicians, participation in training, and observation had a significant positive impact on farmers' adoption of sustainable production technology [38]. Factors such as environmental awareness, sales channels, government subsidies, and publicity all had a positive impact on farmers' willingness to adopt new technologies, whereas farmers' social network relationships and the ease of farmers adopting new technologies had a negative impact on their willingness to adopt new technologies [39]. Land management scale had a significant positive impact on the adoption of new technologies for large grain growers [40]. In the process of technology diffusion, local governments need to increase publicity and guidance [41]. According to a field survey of potato farmers in the Shandong Province, the proportion of agricultural net income had a significant negative impact on the reduction in fertilizer application [42]. The proportion of agricultural income had a significant positive impact on farmers' adoption of conservation tillage technology [43]. The degree of risk aversion negatively affected the adoption of organic production technology by farmers [44]. Easterling and Crosson found that understanding, information, management ability, and natural conditions were the factors hindering farmers from adopting organic agriculture [45]. Lohr et al. analyzed farmers' willingness to adopt organic agriculture in different countries from the perspective of agricultural subsidies [46]. Benbrook et al. analyzed the same from the perspective of market demand [47]. Lobley et al. reported that whether farmers adopt organic agriculture was significantly affected by surrounding farmers [48]. Chen Yusheng and other researchers found that profit expectation and the strictness of external supervision had a positive impact on farmers' adoption of organic agriculture [49]. Yanakittkul further stated that morality and social concerns affected farmers' adoption of organic agriculture and that women's leadership, organizational promotion, and price satisfaction all significantly affected farmers' adoption of organic agriculture [50].

2.3. Development Experience and Policy Comparison of Organic Agriculture

A study of the relationship between agricultural policies in Austria and the development of local organic agriculture since 1991 showed that the Austrian government needs to comprehensively use direct and indirect measures to accelerate the development of organic agriculture in the future [51]. Looking at the history, current situation, and reasons for the development of the German organic agriculture industry, some problems remain in China, such as a low farmer awareness, poor government support, an imperfect standard system, a low degree of organization, few well-known brands in the market, and low consumer trust [52]. François selected the United States for study, systematically analyzed the development history of organic agriculture in the country and the policy support effects of the U.S. government, and provided policy suggestions for the development of organic agriculture in China [22]. Eyhorn studied the development background, policy framework, subsidy standards, regulatory system, and other aspects of European organic agriculture, and compared and analyzed the differences in policies of Germany, Denmark, Spain, France, Italy, and other developed EU countries [53]. The development history, development status, management, research, teaching, training methods, and marketing channels of Dutch organic agriculture showed that Dutch community-supported organic farms provided reference value for the development of organic agriculture in China [54].

Organic agriculture researchers at home and abroad have focused on the investigation of the development status of organic agriculture in various countries, the comparative analysis of organic and conventional agriculture, the exploration of new technologies in organic agriculture, and the government's subsidy policies promoting the construction of organic agriculture. The willingness of farmers to adopt organic agriculture and their behaviors at the micro level have also been discussed. Some scholars have also studied the factors influencing farmers' willingness to engage in organic agriculture and their behaviors. However, most of them unilaterally analyzed farmers' willingness and behavior from different perspectives, often ignoring the possible inconsistency between farmers' willingness to adopt organic agriculture and their behaviors. For farmers' willingness to translate to final behavior, a process from recognition to acceptance is required, which is affected by many factors that may ultimately lead to inconsistency between farmers' behavior and willingness. As such, in this study, we attempted to combine willingness and behavior. We discussed not only the factors that affect farmers' willingness to adopt organic farming and their behavior but also the possible factors that cause the inconsistency between willingness and behavior. Focusing on the farmers' willingness and behavior in organic farming, researchers have generally reported that farmers' willingness to engage in organic farming and their behavior are affected by individual, family, and production characteristics. The higher the education level and family income, the stronger the farmers' willingness to adopt organic farming, and the higher the possibility of actually performing behavior [55]. Others found that the older the farmers, the more willing they were to perform organic farming, but the opposite was true in the choice of actual behavior [56]. The planting scale also plays an opposite role in the choice of farmers' willingness and behavior in organic farming [57]. With advances in research, some scholars have begun to notice the impacts of other factors on farmers' willingness to engage in organic planting and their behavior. Some studies showed that the higher the farmers' awareness of organic agriculture, the stronger their willingness to engage in it, and the higher the possibility of organic planting in actual production [58]. Technical training positively impacted farmers' willingness to grow food organically, but had no significant effect on specific organic planting behavior [59]. The above findings provide some reference for analyzing the causes of the disagreement between farmers' willingness to engage in organic planting and their behavior; however, some problems are worthy of further discussion: (1) Most of the literature has focused separately on the factors influencing farmers' willingness and behavior. However, inconsistencies might exist between willingness and behavior, which require behavior and willingness to be comprehensively investigated as a whole. (2) Reviewing the existing research, we found that the same factor may play an opposite role in the farmers' willingness and behavior, which may lead to the contradiction between farmers' behavior and willingness in organic farming, which has rarely been considered in the literature [60]. In view of this, we assume that a correlation exists between farmers' willingness and their behavior. With a bivariate probit model, we analyzed the factors influencing farmers' willingness to engage in organic agriculture and their behavior and empirically tested the factors causing the inconsistency between willingness and behavior to further improve the research on farmers' behaviors and willingness to adopt organic planting.

3. Methodology

Researchers have mostly designed questionnaires from a subjective perspective and used the logit model to analyze the importance of the influencing factors. Here, we used a semi-open questionnaire to record farmers' independent thoughts and then obtained complete questionnaire results after summarizing. During the field survey, we identified the inconsistencies between farmers' willingness to engage in organic agriculture and their actual behavior through two questions: First, we asked "Are you willing to engage in organic agriculture?". The results showed that 68.86% of farmers said yes; then, we asked about this group's behavior in adopting organic agriculture. We found that only 50.02% of farmers converted their willingness into actual behavior in agricultural production.

This finding showed that although farmers' willingness was high at this stage, the actual adoption rate was relatively low. We found a gap between the early willingness and the later behavior and the inconsistency was notable. To further explain this phenomenon, we selected 306 farmer samples in the Anhui Province and used a bivariate probit model to analyze the factors influencing farmers' willingness to adopt organic farming and their behavior, as well as the possible reasons for inconsistency between willingness and behavior. The farmer behavior theory in the rational small farmer school holds that the farmer is a rational economic person and their willingness and behavior in adopting organic farming are affected by many factors [61]. The theory of planned behavior holds that individual behavior intention is affected by attitude, subjective norms, and perceived behavior control [62]. The decision-making process through which farmers adopt organic methods is complex, which often involves weighing economic and environmental concerns, risk, and other factors [63]. According to the theory of planned behavior, personal characteristics as well as social, economic, and cultural conditions, indirectly affect behavior by influencing the will of farmers [64]. Based on related studies, we analyzed farmers' willingness to engage in organic agriculture and their behavior from the following aspects: individual traits, family characteristics, and understanding.

3.1. Data Sources and Sample Descriptive Analysis

We conducted a survey of Anhui farmers using a questionnaire from July to August 2021.

The Anhui Province is located at 114°54′–119°37′ E and 29°41′–34°38′ N, at the junction of East and Central China near the sea and two rivers. The Yangtze and Huaihe Rivers flow 416 and 430 km through Anhui, respectively. The entire province has outstanding geographical advantages, rich agricultural resources, and produces a large proportion of China's overall agricultural production. Anhui's agriculture industry has rapidly grown in recent years, with the total output increasing from RMB 74.177 billion in 2000 to RMB 356.772 billion in 2020 [65]. Such rapid development has been accompanied by increasingly serious problems for the ecological environment. Therefore, we need to immediately study the development of organic agriculture in Anhui.

In this survey, we selected sample farmers by a process of stage sampling: first, we selected the survey counties using judgment sampling and then selected the sample farmers using quota sampling (Table 1). We divided the questionnaire into two stages. First, we administered a presurvey in five townships in Anqing and Huainan; in each township, we selected 10 farmers using judgment sampling for investigation. Second, we modified and improved the questionnaire according to the answers from the pre-investigation. We then employed the quota sampling method to carry out a formal survey of farmers. We distributed 306 questionnaires and received 287 valid questionnaires for a recovery rate of 93.82%.

Table 1. Regional distribution of questionnaires among the respondents of different areas.

Study Area	Number	Percentage (%)
Bengbu	53	17.32%
Anqing	50	16.34%
Wuhu	52	16.99%
Huainan	45	14.71%
Fuyang	53	17.32%
Tongling	53	17.32%
Total	306	100.00%

Source: Field survey, 2021.

Table 2 shows that most of the farmers in the study were men, accounting for 68.30% of the total. Farmers aged over 50 years accounted for 54.58%. As a result, the overall level of education was relatively low, with 88.89% of the respondents having an education below the junior high school level. Although 60.47% of the farmers in the survey had been engaged in agriculture for 20 years or more, most of the respondents were part-time farmers. For example, more than 60% of the respondents listed "nonagricultural" as their main occupation. Generally, the disposable income of the surveyed farmers was low. In 2021, the per capita disposable income of the majority of the study group was less than RMB 25,000 annually, accounting for 60.46%. The grassroots party members were relatively low in number in rural areas, with only 13.07% of the samples being CPC members (Communist Party of China). The above statistics showed that the local economic development could be described as relatively lagging because of the serious loss of young labors (the middle-aged and elderly were the main labor force), the low levels of education and income, and the insufficient modernization of agriculture.

Table 2. Descriptive characteristics of respondents (n = 306).

Statistic	Category	Number	Percentage (%)
Gender	Female	97	31.70%
	Male	209	68.30%
Age	18–35	43	14.05%
	36–50	96	31.37%
	51–65	132	43.14%
	66–above	35	11.44%
Educational level	Primary school or below	160	52.29%
	Junior school	112	36.60%
	Senior school or technical secondary school	31	10.13%
	College or above	3	0.98%
Years farming	1–10	51	16.67%
	11–20	70	22.88%
	21–30	89	29.08%
	31–40	80	26.14%
	41–above	16	5.23%
Occupation	Part time but mainly agricultural	116	37.91%
	Part time but mainly nonagricultural	190	62.09%
Political status	The masses	266	86.93%
	Member of the CPC	40	13.07%
Annual per capita income (RMB: Yuan)	Below 8000	31	10.13%
	8000–15,000	53	17.32%
	15,000–25,000	101	33.01%
	25,000–45,000	62	20.26%
	45,000–above	59	19.28%

Source: Field survey, 2021.

3.2. Model Setting

The willingness of farmers to engage in organic agriculture and the adoption of organic agriculture production behavior were taken as binary discrete variables. The study considered them as dependent variables in order to investigate whether farmers' willingness to engage in organic agriculture would eventually lead farmers to adopt organic agriculture production behavior. If the two explained variables were separately probit modeled, it might have led to efficiency loss because the two dependent variables of farmers' willingness to engage in organic agriculture and their adoption of organic agriculture production behavior were usually related, that is, there might be a correlation between the disturbance terms of the two probit equations. Therefore, in order to avoid possible efficiency loss, this paper used bivariate probit to study farmers' willingness to engage in organic agriculture and the likelihood of adopting organic agriculture production behavior. Combining these two factors in pairs has four possible outcomes: "willing to engage in organic agriculture and adopts organic agriculture production behavior", "willing to engage in organic agriculture but does not adopt organic agriculture production behavior", "unwilling to engage in organic agriculture but adopts organic agriculture production behavior", and "unwilling to engage in organic agriculture and does not adopt organic agriculture production behavior". The dummy variables y_1 and y_2 were used separately to represent the two choices, with y_1 = 1 representing "willing to engage in organic agriculture", y_1 = 0 representing "unwilling to engage in organic agriculture", y_2 = 1 representing "adopts organic agriculture production behavior", and y_2 = 0 representing "does not adopt organic agriculture production behavior". The combination results of the above observable variables y_1 and y_2 can be expressed as (1, 1), (1, 0), (0, 1), and (0, 0). The model is established as follows:

$$\begin{cases} y_1^* = \alpha_1 x_1^* + \varepsilon_1 \\ y_2^* = \alpha_2 x_2^* + \varepsilon_2 \end{cases} \tag{1}$$

where y_1^* and y_2^* were immeasurable latent variables, which represented the willingness of farmers to engage in organic agriculture and their adoption of organic agriculture production behavior, respectively; x_1^* and x_2^* represented the influencing factors of the willingness of farmers to engage in organic agriculture and their adoption of organic agriculture production behavior, respectively; and disturbance items (ε_1, ε_2) followed the two-dimensional joint normal distribution. The expectation was 0, the variance was 1, and the correlation coefficient was p, namely,

$$\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \sim N\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & p \\ p & 1 \end{pmatrix} \right\} \tag{2}$$

where p was the correlation coefficient of ε_1 and ε_2 and and N was the number of independent variables. y_1^* > 0 meant that farmers were willing to engage in organic agriculture; similarly, y_2^* > 0 meant that farmers adopted organic agriculture production behavior. The relationship between y_1^* and y_1 and y_2^* and y_2 could be determined by the following equation.

$$y_1 = \begin{cases} 1 & \text{if } y_1^* > 0 \\ 0 & \text{if } \mathrm{y}_1^* \leq 0 \end{cases} \tag{3}$$

$$y_2 = \begin{cases} 1 & \text{if } y_2^* > 0 \\ 0 & \text{if } y_2^* \leq 0 \end{cases} \tag{4}$$

The only connections between Equations (3) and (4) were the perturbation terms ε_1 and ε_2. If p = 0, then Equations (3) and (4) were equivalent to two separate probit models. It could be seen that there was no correlation between farmers' willingness to engage in organic agriculture and their adoption of organic agriculture production behavior and vice versa. When $p \neq 0$, the maximum likelihood estimation could be performed according to the value using the probability of (y_1, y_2). using P_{11} as an example, the specific calculation process is as follows:

$$\begin{aligned} & P_{11} = P(y_1 = 1, y_2 = 1) = P(y_1^* > 0, y_2^* > 0) = P(\varepsilon_1 > -\alpha_1 x_1^*, \varepsilon_2 > -\alpha_2 x_2^*) \\ & = \int_{-\infty}^{\alpha_1 x_1^*} \int_{-\infty}^{\alpha_2 x_2^*} \Phi(Z_1, Z_2, p) d_{Z1} d_{Z2} \\ & = \Phi(\alpha_1 x_1^*, \alpha_2 x_2^*, p) \end{aligned} \tag{5}$$

where $\Phi(Z_1, Z_2, p)$ and $\Phi(\alpha_1 x_1^*, \alpha_2 x_2^*, p)$ were the probability density function and cumulative distribution function of the standardized two-dimensional normal distribution, respectively, with an expectation of 0, variance of 1, and correlation coefficient of p. Similarly, P_1, P_{01}, and P_{00} could be calculated and these probabilities were logarithmically summed to obtain the logarithmic likelihood function. Finally, the original hypothesis, "H0: $p = 0$", was tested to decide whether two separate probit models or a bivariate probit model was required. If the test results rejected the original hypothesis, it was necessary to use the bivariate probit model.

3.3. Variable Selection

In this study, the dependent variable was farmers' willingness and behaviors to engage in organic agriculture; we divided the main explanatory variables into the three categories in Table 3.

Table 3. Descriptive statistics of variables.

Variable	Description	Mean	Std.
Dependent variables			
Willing to engage in organic agriculture	No = 0 Yes = 1	0.780432	0.287701
Behavior in engaging in organic agriculture	No = 0 Yes = 1	0.435168	0.211279
Independent variables			
Farmers' traits			
Gender	Female = 0 Male = 1	0.683007	0.285920
Age	18–35 = 1 36–50 = 2 51–65 = 3 65–above = 4	2.519608	1.097631
Educational level	Primary school or below = 1 Junior school = 2 Senior school or Technical secondary school = 3 College or above = 4	1.598039	0.722458
Years farming	1–10 = 1 11–20 = 2 21–30 = 3 31–40 = 4 41–above = 5	1.334651	0.927753
Political status	The masses = 0; Member of CPC = 1	0.130719	0.314692
Family characteristics			
Cultivated area (Unit: km^2)	Below 2 = 1 2–5 = 2 5–10 = 3 10–20 = 4 20–above = 5	2.563891	1.097593
Annual per capita income (RMB: Yuan)	Below 8000 = 1 8000–15,000 = 2 15,000–25,000 = 3 25,000–45,000 = 4 45,000–above = 5	3.212418	1.268765

Table 3. *Cont*.

Variable	Description	Mean	Std.
Proportion of nonagricultural income	Below 15% = 1 15%–30% = 2 30%–45% = 3 45%–60% = 4 60%–above = 5	4.726372	2.399637
Understanding			
Understanding of organic agricultural production technology	Less = 1 Equal = 2 More = 3	1.299619	0.989653
Understanding of economic value of organic agriculture	Less = 1 Equal = 2 More = 3	2.164037	1.140672
Understanding of damage to organic agricultural environment	Less = 1 Equal = 2 More = 3	2.517644	1.228591
Understanding of agricultural waste resource use	Less = 1 Equal = 2 More = 3	2.881013	1.573792

Source: field survey, 2021.

3.3.1. Farmers' Traits

This group mainly included sex, age, education level, years farming, and political status of farmers. Generally, men account for the main labor force in agricultural production. In the primary stage of organic agriculture development, when the input–output ratio of organic agriculture was not significant compared with traditional agriculture, men preferred traditional agriculture techniques as a method to reduce risk and were unwilling to engage in organic agriculture. The older the farmers, the less inclined they were to understand and accept new methods or information [66]. They were also more likely to exhibit path dependence and a reduction in willingness to engage in organic agriculture. An increase in education could raise farmer awareness and the likelihood of their engaging in organic agriculture. Party members are known to be propagandists and followers of national principles and policies. They are more advanced in their ideological awareness and cognitive abilities and, as a result, are more willing to engage in organic agriculture, often playing exemplary or leading roles. The more years spent farming, the higher the proportion of income from agriculture and the more familiar the farmers were with agricultural production economics. Farmers with more experience were more aware of the possible impacts on the environment and showed an increased chance of engaging in organic agriculture. Growers with training in organic agriculture production had a better understanding of the methods and production environment, were more likely to accept the new agricultural model of organic agriculture, and were more willing to engage in organic agriculture [67].

3.3.2. Family Characteristics

This group included cultivated land area, annual per capita income, and nonagricultural income. We expected the size of cultivated land to have a certain impact on farmers' willingness to adopt organic agriculture and their behaviors. Perhaps farmers had a certain willingness to engage in organic agriculture, but considering the cost and risk, the possibility of large-scale organic planting was reduced. Farmers with a high disposable income per capita had a stronger capability to withstand risk and agricultural investment [68]. Therefore, they were more willing to engage in the new agricultural production mode of organic agriculture. Households whose nonagricultural income accounted for a large proportion of their total income did not primarily focus on agriculture, so they were less concerned with or less aware of the improvements in agricultural technology related to organic agriculture [69].

3.3.3. Understanding Variables

This group of variables includes the understanding of organic agricultural production technology, economic value, environmental damage and hazards, and the understanding of agricultural waste resource use. The more farmers understood the technology used in the production of organic agriculture, the more likely they were to adopt such tools [70]. Therefore, technical training is important. The economic goal of organic farming is to increase the income of farmers and improve living standards. The higher the farmers' understanding of the economic value of organic agriculture, the more likely they were to engage in the practice. The more the organic agricultural environment was understood, the higher the likelihood of realizing the importance of the organic agricultural environment, and the more likely they were to engage in agriculture that is conducive to conserving the natural environment. The better the understanding of the behaviors that lead to the destruction of the organic agricultural environment, the higher the farmers' awareness of protecting the agricultural environment, and the more conducive for farmers to engage in organic agriculture [71]. Household waste disposal affects farmer understandings of the environment, changing their behavior toward the engagement in organic agricultural production. The more favorable the household garbage treatment to the environment, the stronger the family's awareness of environmental protection in everyday life, which indirectly increased the possibility of farmers engaging in organic agriculture. The greener the treatment of livestock and poultry manure by farmers, the more likely the farmers are to engage in agricultural production, being more conducive to protecting the agricultural environment [72]. Such changes directly benefit farmers engaged in organic agricultural production.

4. Results

In this paper, the Stata14.0 software was used to fit the model and the estimated results are shown in Table 4. The results showed that the log likelihood value of the model was −338.48, the chi square value was 142.27, and the p value was 0.000. The model passed the significance test at the 1% statistical level, $p = 0.249$, indicating that there was a certain complementary effect between farmers' willingness to engage in organic agriculture and their adoption of organic agriculture production methods; that is, the level of farmers' willingness had a positive impact on the adoption of organic agriculture production. For the original assumption, "H0: $p = 0$", the Wald test showed that the p value was 0.0185, indicating that the bivariate probit model should be used to complete parameter estimation. The survey results showed that the vast majority of farmers who had a certain degree of willingness to engage in organic agriculture had adopted organic agriculture production methods, whereas 69.98% of the farmers who had not adopted organic agriculture production methods lacked willingness.

According to the estimation results in Table 4, we found the main factors influencing farmers' willingness to engage in organic agriculture and their behaviors could be summarized as follows:

Table 4. Results of the bivariate probit model.

Variables	Willingness Model			Behavior Model			Marginal Effect	
	Coefficient	Std. Error	p	Coefficient	Std. Error	p	Coefficient	Std. Error
Gender	−0.2777 ***	0.1422	0.1561	−0.0978 *	0.1819	0.7112	0.0221	0.0127
Age	−0.0346 ***	0.1154	0.7983	−0.1389	0.1228	0.2113	−0.0047 *	0.0021
Educational level	0.4037	0.1612	0.7998	0.4187	0.2113	0.3568	0.0317	0.0106
Years farming	−0.3648 ***	0.0196	0.5127	−0.1579	0.0137	0.2147	−0.0575	0.0237
Political status	0.4969 **	0.3021	0.1013	0.2543	0.3267	0.3126	0.1105	0.0191

Table 4. *Cont.*

Variables	Willingness Model			Behavior Model			Marginal Effect	
	Coefficient	**Std. Error**	***p***	**Coefficient**	**Std. Error**	***p***	**Coefficient**	**Std. Error**
Cultivated area (km^2)	−0.3072	0.0953	0.3001	−0.3099	0.0865	0.3451	0.0278	0.0139
Per capita income (RMB)	0.1012	0.0855	0.7548	0.0475	0.0599	0.7021	0.0227	0.0111
Proportion of nonagricultural income	−0.0131	0.0129	0.2968	−0.0203	0.0112	0.2775	− 0.0110	0.0121
Understanding of organic agricultural production technology	0.5133 **	0.2294	0.0857	0.2458	0.1778	0.3015	0.0422	0.0209
Understanding of economic value of organic agriculture	0.1874 **	0.0983	0.1956	0.0775	0.0909	0.5001	0.0516	0.0238
Understanding of damage to organic agricultural environment	0.5024 ***	0.1236	0.0000	0.3121 **	0.0901	0.0214	0.0511	0.0317
Understanding of agricultural waste resource utilization	−0.3011 ***	0.0275	0.0000	0.0523 *	0.0891	0.0427	0.0499	0.0804

"***", "**", and "*" show significant at 1%, 5%, and 10% levels, respectively.

4.1. Impact of Basic Farmer Characteristics

- The sex coefficient of farmers in the willingness and behavior models was negative, which was consistent with the expectation, and both passed the significance test. This showed that men, as the center of the family and agricultural production, were more reluctant to engage in organic agriculture to ensure the stability of family life and agricultural income. However, sex had little impact on farmer willingness to engage in organic agriculture or behavior.
- Age significantly affected farmers' willingness to adopt organic agriculture and the coefficient was negative. The older the farmers, the less likely they were to understand organic agriculture and adopt organic production. The statistical results showed that the marginal effect of the age variable was −0.047 and the significance test was passed at the 10% level, showing that as individual age advanced, the probability of farmers' understandings of organic agriculture development and adoption of organic production behavior reduced by 0.47%.
- The education level of farmers was positive in the willingness and behavior models, which was consistent with the expectation, but neither passed the significance test. The higher the education level of the farmers, the better their understanding of and the higher the likelihood that they engaged in organic agriculture. However, the model showed that education level had little impact on farmers' willingness to engage in organic agriculture or their behavior. The reason for this finding might be that more than 80% of the farmers in the survey had an education lower than junior high school, which indicated that farmers with a higher level of education no longer focused on agricultural production but worked in cities or other nonagricultural industries.
- Years of experience in farming significantly affected farmers' willingness and behavior and the coefficient was negative, indicating that the more years in farming, the more likely they were to lack an awareness of and willingness toward the engagement in organic agriculture and the less likely they were to adopt organic agriculture behavior. The results of the marginal effect estimation showed that the probability of farmer willingness to adopt organic agricultural production behavior would decrease by 5.7% for each increase in farming years.

- The coefficient of farmers' political status in the willingness and behavior models was positive, which was consistent with the expectation. In the willingness model, the farmers' political status was significant at the 5% level, but failed to pass the significance test in the behavior model, showing that party-member farmers played an exemplary role in the willingness to engage in organic agriculture and the publicity of agricultural policies and significantly enhanced the willingness of farmers to engage in organic agriculture. However, in actual organic agriculture production, party-member farmers did not play a leading role. The reason for the inconsistency between their willingness and actual behavior might be that although party-member farmers recognized the variety of benefits of organic agricultural production and were willing to engage in organic methods, under the current situation where China's organic agricultural production standards, quality system, and certification system are not perfect, compared with traditional agriculture, moving to organic agriculture would increase costs and income risks. Therefore, in the practice of agricultural production, party-member farmers might require more experience.

4.2. Influence of Family Characteristics

- The b value of cultivated land area in the willingness and behavior models was negative, but the result was not significant, which indicated that the cultivated land area was negatively correlated with farmers' organic production behavior and was not significant. The reason for this finding was that the survey objects were mainly small farmers, with small land differences and land scales, so the impact of cultivated land area was not significant. Some studies have also shown that the smaller the cultivated land, the more likely the land was to be intensively cultivated, and the more likely organic agricultural production would be introduced, which made cultivated land area more negative with organic production behavior.
- The coefficient of per capita income in the willingness and behavior models was positive, which was consistent with the expectation, but neither passed the significance test. Farmers with higher household incomes had a higher antirisk ability and increased access to information, but this had little impact on the farmers' willingness to engage in organic agriculture or their behaviors. The reason here might be that the survey area was rural Anhui, where the local economic development level was low and farmers were engaged in agricultural production with economic benefits as the center. The existing income level did not significantly increase the risk aversion ability or the investment tendency of farmers to be engaged in organic agriculture. Therefore, the impact on farmer participation in organic agricultural production was not significant.
- The nonagricultural income accounted for a large proportion of total income in rural households and the majority of revenue for high-income households did not come from agricultural production, which reduced its impact on production behavior. This showed that farmers with higher wage incomes paid less attention to the application of and improvement in agricultural production technology, which resulted in a negative correlation with the willingness to engage in organic agricultural production and the adoption of related technologies. Moreover, due to the concentration of social resources such as educational resources, many farmers sought to improve their living standards by purchasing houses in cities rather than working to improve the rural living environment. Additionally, the majority of the study sample were small farmers, who had less impact on the environment and less willingness to improve the rural living environment. Therefore, in this study, nonagricultural income was less likely to have a significant impact on production behavior.

4.3. Impact of Understanding

- Understanding the difficulty of mastering organic agricultural production technology significantly affected farmers' adoption of organic production behavior and the coefficient was positive, whereas the impacts on their adoption of organic production behavior was not significant and the direction was negative. A possible reason for this finding is that farmers did not understand the technology at present. The results of statistical analysis showed that 44.51% of the interviewed farmers believed that they could not or could not easily master agricultural organic production technology, even with some training or explanation.

- The coefficient of economic value understanding in the willingness and behavior models was positive, which was consistent with the expectation, and was significant at the 5% level in the willingness model, but it failed to pass the significance test in the behavior model. The stronger the farmers' awareness of environmental protection, the more likely they were to engage in organic agriculture. The economic value of the organic agricultural environment had a significant positive impact on farmers' willingness to engage in organic agriculture, indicating that when farmers understood the organic agricultural environment, its economic value was an important factor affecting their willingness to engage in organic agriculture. In the behavior model, the understanding of the environmental economic value of organic agriculture did not significantly affect the behavior of farmers toward engagement in organic agriculture. The reason might be that although farmers agreed with the economic value of organic techniques and hoped that organic production could increase their agricultural income, the protection of the organic agricultural environment and the adoption of organic agricultural behavior had not in the short term produced any of the expected benefits in reality. In consideration of economic incomes, farmers often continued to perform actions that did not consider of the negative externalities of the environment [73].
- The coefficient of hazard understanding was positive in the willingness and behavior models, which was consistent with the expectation, and was highly significant at the 1% and 5% levels, respectively. In recent years, the excessive use of chemical fertilizers and pesticides has led to soil and water pollution, resulting in frequent quality and safety problems for agricultural products. This has seriously affected the quality of life of urban and rural residents. The regression results showed that farmers' awareness of the environmental protection provided by organic agriculture was stronger and they were more inclined toward organic agricultural production in terms of willingness and behavior after suffering damage caused by the destruction of the agricultural environment. The increase in farmer awareness of environmental protection did not mainly come from positive environmental protection, but from the harm caused by environmental damage. The reason for this negative transmission mechanism was closely related to the long-standing phenomenon of pollution before treatment in China's economic development [74].
- The coefficient of agricultural waste utilization in the willingness model was negative, which was inconsistent with our expectation. In the behavior model, the coefficient was positive, which was consistent with expectations. In the two models, it was significant at the levels of 1% and 10%, respectively, and there was inconsistency between the willingness and adoption. The method of agricultural waste utilization, to a certain extent, can reflect farmers' awareness of environmental protection, and affect users' willingness to engage in organic agriculture. The utilization of agricultural waste did not promote willingness to engage in organic agriculture, but played a restraining role, which was inconsistent with expectations. The reasons might be that most of the agricultural waste in villages was directly discharged without effective utilization, long-term habits were difficult to change in the short term, and farmers find it difficult to change psychologically and behaviorally, resulting in negative effects. In terms of engaging in organic agriculture, the utilization of agricultural waste significantly promoted the behavior of farmers engaged in organic agriculture. The reasons might be that the utilization of agricultural waste improved farmers' production and living environment, improved farmers' awareness of environmental protection, and made farmers more likely to adopt organic agricultural production behavior.

5. Discussion

Based on the survey data of 306 farmers in Anhui Province, we analyzed the factors influencing farmers' willingness to engage in organic agriculture and their behavior by using a bivariate probit model. In the analysis, according to the farmer behavior theory, we focused on analyzing the influence of farmers' individual characteristics, family characteristics, and variables related to farmers' understandings of organic agriculture and the agricultural environment. We discussed the possible inconsistency between willingness and behavior from the different effects of some factors. Our findings, to some extent, filled the gap in the theoretical literature on farmers' willingness to engage in organic agriculture and their behaviors and provide a practical reference for relevant decision makers and farmers. The results showed that a correlation existed between farmers' willingness to engage in organic agriculture and their behavior in adopting organic agriculture, but we found large differences in the impacts of variables on farmers' willingness and behavior, which explains the inconsistency between farmers' willingness and behavior to a certain extent. (1) In terms of individual characteristics, farmers' age, years of farming, etc. all had impacts on farmers' willingness and behaviors to adopt organic production, but the extent of the impacts was different in the willingness model and behavior model; in addition, the identity of the Party member had a significant restraining effect on the inconsistency of farmers' willingness and behavior to adopt organic production. This finding was the same as He Yue's suggestion that the higher the personal political awareness, the stronger the willingness of adopting organic agriculture [75]. (2) In terms of family characteristics, cultivated area, per capita income, proportion of nonagricultural income, etc. had different degrees of influence on farmers' willingness and behavior to adopt organic production, which was consistent to some extent with Serebrennikov's conclusions that farmers' willingness to adopt organic agriculture was affected by family incomes and cultivated areas [76]; however, maybe due to the fact that the study area and sample selection in this paper were small-scale farmers in rural areas, the impacts of the cultivated land area and per capita income was contrary to expectations in the two models. (3) In terms of understanding, farmers' understanding of organic agricultural technology and the economic value of organic agriculture had a positive impact in the willingness model and behavior model and had a significant impact on willingness; the understanding of organic environmental protection and agricultural waste resource utilization had a significant positive impact in both willingness and behavior models. This finding showed that improving farmers' awareness of organic agriculture and the organic environment can effectively restrain the inconsistency between willingness and behavior. This was in line with Sapbamrer's emphasis on the importance of improving agricultural cognitive ability [77].

6. Conclusions and Policy Implications

According to the field survey results, farmers' current willingness to adopt organic agriculture was relatively high, but their behavior was insufficient. Of the farmers, 68.08% showed inconsistency between their willingness and behavior. To overcome inconsistency, the underlying reasons behind the inconsistency must be further weighed. Therefore, the following conclusions and policy implications can be suggested:

(1) Willingness and behavior are not the same. When analyzing farmers' intentions to engage in organic farming, we should distinguish their willingness and behavior, understand what factors hinder the transformation of willingness to behavior and reduce the inconsistency between farmers' willingness to adopt organic agriculture and actual behavior.

(2) Farmers should be guided to continuously expand the cultivated land area and to promote large-scale agricultural operation. Farmers should be encouraged to carry out land transfer according to local conditions, to accelerate the transfer of contractual management rights, and to promote large-scale operation. The education level of farmers should be improved, and highly educated people should be encouraged to engage in agricultural production. From the survey, we found that the cultural level

of farmers was low, which is also a common problem in the education of farmers in China. Therefore, the government should create conditions to attract highly educated talents to participate in industries related to ecological farming, to raise the education level of agricultural workers, and to build a foundation for the development of organic farming.

(3) The farmers' understanding of organic agriculture should be improved through multiple channels. The farmers' understanding of organic agriculture affects behavioral choices, so improving their understanding of organic agriculture can improve organic behavior. First, space should be provided to the role of the news media to increase publicity around the concept of organic agriculture development through available outlets and to build awareness of the harm caused to the environment by the excessive use of pesticides and fertilizers and the nonstandard treatment of membrane waste. The economic benefits of the scientific use of drugs and fertilizers are substantial, furthering the desire of farmers to preliminarily understand the necessity of organic production. Additionally, the government can help growers understand organic production technology by establishing demonstration centers, which can act as models to educate and reduce any fears surrounding organic production, reduce the evaluated level of risk of organic production, and increase the overall confidence in organic farming methods [78].

(4) Subsidy policies should be implemented and the development of organic agriculture should be encouraged. The survey results showed that economic benefits have a significant impact on organic agricultural production behavior. The adoption of organic production technology has led to increased costs, yet income has not increased enough in the short term to compensate for the loss of income. The government can reduce the production costs for farmers and guide their organic production behavior through financial subsidies, encouraging farmers to join the new business market and facilitating the development of local brands and the certification of organic products. A new production system, as well as a management and industrial system for organic agriculture, should be established and improved. Security systems should be formulated, reducing the risks for farmers transitioning to the new environment and improving the benefits of organic agriculture. Whether farmers adopt an emerging technology is also affected by the risk of the technology, such as the possible reduction in benefits in the short or relatively long term [79]. Due to the high initial cost of some organic agricultural sowing technologies and the high market and natural risks faced by organic agricultural planting, a sudden market price risk or natural risk will result in losses in farmer incomes. Therefore, in addition to creating national agricultural insurance, the local government should also encourage insurance companies to launch more agricultural benefit insurance businesses according to the current situation. Through the establishment of an all-inclusive agricultural insurance system, the basic interests of farmers can be ensured, reducing concern and fear toward the application of new technologies and promoting the adoption of agricultural organic planting technologies.

(5) Environmental protection policies should be promoted. Organic agriculture can not only ensure the sustainable use of limited resources but also protect the environment and reduce ecological damage, reversing the damage caused by pollution before treatment [48]. Here, the purposes of formulating agricultural ecological subsidy policies are to strengthen environmental protection publicity in rural areas, enhance farmers' awareness of environmental protection, promote farmers' green and organic production, and improve the quality of agricultural products. Farmers who engage in organic agricultural production according to established standards should be given ecological subsidies, and certification fees should also be reimbursed with corresponding subsidies. The subsidy standard should be based on the amount of farmer investment in agricultural ecological construction. Farmers who employ organic fertilizers, biological pesticides, mechanical weeding, and other environmental

protection production should be rewarded to create enthusiasm for environmental protection and organic agriculture. Those who abuse pesticides or resort to fraud and moral perils should be accordingly punished. Together, we can strengthen the construction of the rural infrastructure, improve the living environment of rural residents, and further enhance the awareness of environmental protection and farmer willingness to engage in organic agriculture, while also establishing a long-term mechanism for and ensuring the smooth progress of rural environmental pollution control and environmental protection.

(6) Technical support for the development of organic agriculture should be strengthened. A certain distance remains between the willingness to adopt organic agriculture and the actual behavior, although many methods, such as the innovative development of agricultural technology extension systems and green ecological agriculture subsidy policies, have been adopted to reduce this inconsistency. However, the root of this problem is whether some errors exist in the thinking of R&D and the promotion of organic agricultural technology. The progress of agricultural science and technology has produced many new organic technologies and the key to realizing the organic transformation of agricultural development is farmers finally adopting and applying the technologies, rather than the excessive pursuit of high-tech agricultural technology research and development. Even though farmers understand the advantages of the corresponding technology and have the willingness to adopt it, China's agricultural management is still dominated by small farmers. The resource endowment constraints have reduced the practicality and ease of the use of technology; ultimately, farmers failed to engage in practical behavior. For this reason, the current agricultural technology innovation should consider improving the practicability and ease of use of organic technology and should actively explore traditional green production methods such as green manure planting and crop rotation. Modern science and technology should be combined to adapt to the new environment. Changing the focus of agricultural technology research and finding and solving the problems in the practical application of organic technology in the current situation will play a crucial role in rapidly improving the level of agricultural green production. As we focused on farmers, we did not further consider the attributes of agricultural technology, which will be the focus of our research in the future. In addition, due to limited funds, the scope of sample selection was limited to Anhui in this study. In future research, it is needed to expand the sample selection area to improve the representativeness and typicality of the samples.

Author Contributions: Conceptualization, X.Z. and D.D.; Data curation, X.Z.; Formal analysis, X.Z. and D.D.; Funding acquisition, X.Z.; Investigation, X.Z.; Methodology, D.D.; Project administration, X.Z.; Resources, D.D.; Software, X.Z.; Supervision, D.D.; Validation, X.Z. and D.D.; Visualization, D.D.; Writing—original draft, X.Z.; Writing—review & editing, D.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Anhui Provincial Department of Education, grant number SK2019A0752.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Yang, C.Y.; Chang, T.Y. A study on the regulations, related to the organic leisure farmsbased on the amended provisions of the certifification criteria for organic agricultural products and organic agricultural processed products perspetive. *J. Tour. Leis. Manag.* **2017**, *5*, 130–138. [CrossRef]
2. Lee, F.; Yin, C. Study on the mechanism of the deviation between farmers' willingness and behavior in green planting. *Contemp. Econ. Manag.* **2021**, *43*, 59–67. [CrossRef]
3. Qiao, D.; Li, N.; Cao, L.; Zhang, D.; Zheng, Y.; Xu, T. How Agricultural Extension Services Improve Farmers' Organic Fertilizer Use in China? The Perspective of Neighborhood Effect and Ecological Cognition. *Sustainability* **2022**, *14*, 7166. [CrossRef]
4. Zhu, Y.; Huo, C. The Impact of Agricultural Production Efficiency on Agricultural Carbon Emissions in China. *Energies* **2022**, *15*, 4464. [CrossRef]
5. Zhou, G.; Gao, S.; Lu, Y.; Liao, Y.; Nie, J.; Cao, W. Co-incorporation of Green Manure and Rice Straw Improves Rice Production, Soil Chemical, Biochemical and Microbiological Properties in a Typical Paddy field in Southern China. *Soil Tillage Res.* **2020**, *197*, 104499. [CrossRef]
6. Guo, X.X.; Liu, H.T.; Zhang, J. The role of Biochar in Organic Waste Composting and Soil Improvement: A review. *Waste Manag.* **2020**, *102*, 884–899. [CrossRef]
7. Zhang, X.; Liu, H.; Huang, B. Research on the factors affecting the application of low carbon technology in agriculture. *Ecol. Econ.* **2018**, *34*, 25–30. [CrossRef]
8. Yazdanpanah, M.; Moghadam, M.T.; Zobeidi, T.; Turetta, A.P.D.; Eufemia, L.; Sieber, S. What factors contribute to conversion to organic farming? Consideration of the Health Belief Model in relation to the uptake of organic farming by Iranian farmers. *J. Environ. Plan. Manag.* **2022**, *65*, 907–929. [CrossRef]
9. Barbieri, P.; Pellerin, S.; Seufert, V.; Smith, L.; Ramankutty, N.; Nesme, T. Global option space for organic agriculture is delimited by nitrogen availability. *Nat. Food* **2021**, *2*, 363–372. [CrossRef]
10. Lu, H.L.; Chang, Y.H.; Wu, B.Y. The Compare Organic Farm and Conventional Farm to Improve Sustainable Agriculture, Ecosystems, and Environment. *Org. Agric.* **2020**, *10*, 409–418. [CrossRef]
11. Chuan, L.; Zheng, H.; Sun, S.; Wang, A.; Liu, J.; Zhao, T.; Zhao, J. A Sustainable Way of Fertilizer Recommendation Based on Yield Response and Agronomic Efficiency for Chinese Cabbage. *Sustainability* **2019**, *11*, 4368. [CrossRef]
12. Hou, Y.; Luo, T.; Hao, J. Analysis of Determinants Affecting Organic Production: State Evidence from the United States. *Sustainability* **2022**, *14*, 503. [CrossRef]
13. Dimitri, C.; Baron, H. Private Sector Support of the Farmer Transition to Certified Organic Production Systems. *Org. Agric.* **2020**, *10*, 261–276. [CrossRef]
14. Tang, Q.; Cotton, A.; Wei, Z.; Xia, Y.; Daniell, T.; Yan, X. How does partial substitution of chemical fertiliser with organic forms increase sustainability of agricultural production? *Sci. Total Environ.* **2022**, *803*, 149933. [CrossRef] [PubMed]
15. Martínez, F.D.G.; Castorena, E.V.G.; Uribe, V.V.E.; Alvarado, R.E.V.; Sáenz, E.O.; Castorena, M.D.C.G. Sustainability of the Soil Resource in Intensive Production with Organic Contributions. *Agronomy* **2022**, *12*, 67. [CrossRef]
16. Connor, D.J. Relative yield of food and efficiency of land-use in organic agriculture-A regional study. *Agric. Syst.* **2022**, *199*, 103404. [CrossRef]
17. Puvača, N.; Tufarelli, V. Sustainable Organic Agriculture for Developing Agribusiness Sector. *Sustainability* **2022**, *14*, 10781. [CrossRef]
18. Seufert, V.; Ramankutty, N.; Foley, J.A. Comparing the Yields of Organic and Conventional Agriculture. *Nature* **2012**, *485*, 229–232. [CrossRef]
19. Bouttes, M.; Darnhofer, I.; Martin, G. Converting to Organic Farming as a Way to Enhance Adaptive Capacity. *Org. Agric.* **2019**, *9*, 235–247. [CrossRef]
20. Çalık, A. The Importance of Organic Agriculture and Şanlıurfa Farmers' Perspectives on Organic Products. *Turk. J. Agric. Food Sci. Technol.* **2020**, *8*, 728–732. [CrossRef]
21. Singh, M. Organic farming for sustainable agriculture. *Indian J. Org. Farming* **2021**, *1*, 1–8. [CrossRef]
22. Dessart, F.J.; Barreiro-Hurlé, J.; Van Bavel, R. Behavioural factors affecting the adoption of sustainable farming practices: A policy-oriented review. *Eur. Rev. Agric. Econ.* **2019**, *46*, 417–471. [CrossRef]
23. Moeller, C.; Sauerborn, J.; de Voil, P.; Manschadi, A.M.; Pala, M.; Meinke, H. Assessing the sustainability of wheat-based cropping systems using simulation modelling: Sustainability= 42? *Sustain. Sci.* **2014**, *9*, 1–16. [CrossRef]
24. Rahman, M.H.; Haque, K.S.; Khan, M.Z.H. A Review on Application of Controlled Released Fertilizers Influencing the Sustainable Agricultural Production: A Cleaner Production Process. *Environ. Technol. Innov.* **2021**, *23*, 101697. [CrossRef]
25. Sammauria, R.; Kumawat, S.; Kumawat, P.; Singh, J.; Jatwa, T.K. Microbial Inoculants: Potential tool for Sustainability of Agricultural Production Systems. *Arch. Microbiol.* **2020**, *202*, 677–693. [CrossRef]
26. De Oliveira, M.A.; de Souza, V.M.; Bergamini, A.M.M.; De Martinis, E.C.P. Microbiological Quality of Ready-to-eat Minimally Processed Vegetables Consumed in Brazil. *Food Control* **2011**, *22*, 1400–1403. [CrossRef]
27. Läpple, D.; Kelley, H. Spatial dependence in the Adoption of Organic Drystock Farming in Ireland. *Eur. Rev. Agric. Econ.* **2015**, *42*, 315–337. [CrossRef]
28. Raynolds, L.T. The Globalization of Organic Agro-Food Networks. *World Dev.* **2004**, *32*, 725–743. [CrossRef]

29. Chabert, A.; Sarthou, J.P. Conservation Agriculture as a Promising Tade-off between Conventional and Organic Agriculture in Bundling Ecosystem Services. *Agric. Ecosyst. Environ.* **2020**, *292*, 106815. [CrossRef]
30. Bendjebbar, P.; Fouilleux, E. Exploring National Trajectories of Organic Agriculture in Africa: Comparing Benin and Uganda. *J. Rural Stud.* **2022**, *89*, 110–121. [CrossRef]
31. Aksoy, M.; Karademir, B.; Kadirhanoğulları, İ.H. Organic Agriculture Comprehension of Soil Agriculture Farmers in Amasya Province of Turkey. *Turk. J. Agric. Food Sci. Technol.* **2021**, *9*, 2065–2072. [CrossRef]
32. Ajzen, I. the Theory of Planned Behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [CrossRef]
33. Hirsh, J.B.; Lu, J.G.; Galinsky, A.D. Moral Utility Theory: Understanding the Motivation to Behave (Un)ethically. *Res. Organ. Behav.* **2018**, *38*, 43–59. [CrossRef]
34. Bencze, S.; Makádi, M.; Aranyos, T.J.; Földi, M.; Hertelendy, P.; Mikó, P.; Bosi, S.; Negri, L.; Drexler, D. Re-introduction of Ancient Wheat Cultivars into Organic Agriculture—Emmer and Einkorn Cultivation Experiences under Marginal Conditions. *Sustainability* **2020**, *12*, 1584. [CrossRef]
35. Shade, J.; Noll, L.C.; Seufert, V.; Galloway, J.N.; Erisman, J.W. Decreasing Reactive Nitrogen Losses in Organic Agricultural Systems. *Org. Agric.* **2021**, *11*, 217–223. [CrossRef]
36. Baker, B.P.; Green, T.A.; Loker, A.J. Biological Control and Integrated Pest Management in Organic and Conventional Systems. *Biol. Control* **2020**, *140*, 104095. [CrossRef]
37. Godfray, H.C.J.; Aveyard, P.; Garnett, T.; Hall, J.W.; Key, T.J.; Lorimer, J.; Pierrehumbert, R.T.; Scarborough, P.; Springmann, M.; Jebb, S.A. Meat Consumption, Health, and the Environment. *Science* **2018**, *361*, eaam5324. [CrossRef]
38. Saha, D.; Kaye, J.P.; Bhowmik, A.; Bruns, M.A.; Wallace, J.M.; Kemanian, A.R. Organic Fertility Inputs Synergistically Increase Denitrification-Derived Nitrous Oxide Emissions in Agroecosystems. *Ecol. Appl.* **2021**, *31*, e02403. [CrossRef]
39. Bazaluk, O.; Yatsenko, O.; Zakharchuk, O.; Ovcharenko, A.; Khrystenko, O.; Nitsenko, V. Dynamic Development of the Global Organic Food Market and Opportunities for Ukraine. *Sustainability* **2020**, *12*, 6963. [CrossRef]
40. Ahmed, T.S.; Alqaisi, M.R.; Zahwan, T.A. Evaluation of Seed Yield, oil, and Fatty Acid Ratio in Medicinal Pumpkin Grown according to Traditional Cultivation and Different Programs of Organic Farming. *Org. Agric.* **2022**, *12*, 33–46. [CrossRef]
41. Zagata, L.; Hrabák, J.; Lošťák, M. Post-socialist Transition as a Driving Force of the Sustainable Agriculture: A Case Study from the Czech Republic. Agroecol. *Agroecol. Sustain. Food Syst.* **2020**, *44*, 238–257. [CrossRef]
42. Nicolay, G.L.; Chikopela, L.; Diarra, B.; Fliessbach, A. Modeling Farm Behaviour on Soil Fertility with the Policy Variable: A Case from Africa. *Org. Agric.* **2020**, *10*, 43–56. [CrossRef]
43. Das, S.; Chatterjee, A.; Pal, T.K. Organic Farming in India: A Vision towards a Healthy Nation. *Food Qual. Saf.* **2020**, *4*, 69–76. [CrossRef]
44. Łuczka, W.; Kalinowski, S. Barriers to the Development of Organic Farming: A polish case study. *Agriculture* **2020**, *10*, 536. [CrossRef]
45. Easterling, W.E.; Crosson, P.R.; Rosenberg, N.J.; McKenney, M.S.; Katz, L.A.; Lemon, K.M. Agricultural Impacts of and Responses to Climate Change in the Missouri-Iowa-Nebraska-Kansas (MINK) Region. *Clim. Chang.* **1993**, *24*, 23–61. [CrossRef]
46. Lohr, L.; Salomonsson, L. Conversion Subsidies for Organic Production: Results from Sweden and Lessons for The United States. *Agric. Econ.* **2000**, *22*, 133–146. [CrossRef]
47. Benbrook, C.; Kegley, S.; Baker, B. Organic Farming Lessens Reliance on Pesticides and Promotes Public Health by Lowering Dietary Risks. *Agronomy* **2021**, *11*, 1266. [CrossRef]
48. Durán-Lara, E.F.; Valderrama, A.; Marican, A. Natural Organic Compounds for Application in Organic Farming. *Agriculture* **2020**, *10*, 41. [CrossRef]
49. Qiu, G.; Yin, J.; Geng, S. Impact of Climate and Land-use Changes on Water Security for Agriculture in Northern China. *J. Integr. Agric.* **2012**, *11*, 144–150. [CrossRef]
50. Yanakittkul, P.; Aungvaravong, C. A Model of Farmers Intentions towards Organic Farming: A Case Study on Rice Farming in Thailand. *Heliyon* **2020**, *6*, e03039. [CrossRef]
51. Clark, S. Organic Farming and Climate Change: The Need for Innovation. *Sustainability* **2020**, *12*, 7012. [CrossRef]
52. Le Campion, A.; Oury, F.X.; Heumez, E.; Rolland, B. Conventional Versus Organic Farming Systems: Dissecting Comparisons to Improve Cereal Organic Breeding Strategies. *Org. Agric.* **2020**, *10*, 63–74. [CrossRef]
53. Eyhorn, F.; Muller, A.; Reganold, J.P.; Frison, E.; Herren, H.R.; Luttikholt, L.; Mueller, A.; Sanders, J.; Scialabba, N.E.-H.; Seufert, V.; et al. Sustainability in Global Agriculture Driven by Organic Farming. *Nat. Sustain.* **2019**, *2*, 253–255. [CrossRef]
54. Golijan-Pantović, J.; Sečanski, M. Biopesticides in Organic Agriculture. *Contemp. Agric.* **2022**, *71*, 141–154. [CrossRef]
55. O'Brien, T.; Creţan, R. The Role of Identity in the 2015 Romanian Shepherd Protests. *Identities* **2019**, *26*, 70–488. [CrossRef]
56. Khan, M.I.; Gwon, H.S.; Alam, M.A.; Song, H.J.; Das, S.; Kim, J. Short Term Effects of Different Green Manure Amendments on the Composition of Main Microbial Groups and Microbial Activity of a Submerged Rice Cropping System. *Appl. Soil Ecol.* **2020**, *147*, 103400. [CrossRef]
57. Onyenali, T.; Olowe, V.; Fabunmi, T.; Soretire, A. Organic Fertilizers Improve the Growth, Seed Quality and Yield of Newly Released Soybean (*Glycine max* (L.) Merrill) Varieties in the Tropics. *Org. Agric.* **2020**, *10*, 155–170. [CrossRef]
58. Moreno, J.R.; Pinna-Hernández, G.; Fernández, M.F.; Molina, J.S.; Díaz, F.R.; Hernández, J.L.; Fernández, F.A. Optimal Processing of Greenhouse Crop Residues to use as Energy and CO2 sources. *Ind. Crop. Prod.* **2019**, *137*, 662–671. [CrossRef]

59. Zemo, K.H.; Termansen, M. Farmers' willingness to participate in collective biogas investment: A discrete choice experiment study. *Resour. Energy Econ.* **2018**, *52*, 87–101. [CrossRef]
60. Liu, T.; Bruins, R.J.F.; Heberling, M.T. Factors Influencing Farmers' Adoption of Best Management Practices: A Review and Synthesis. *Sustainability* **2018**, *10*, 432. [CrossRef]
61. Scalvedi, M.L.; Saba, A. Exploring Local and Organic Food Consumption in a Holistic Sustainability View. *Br. Food J.* **2018**, *120*, 749–762. [CrossRef]
62. Ham, M.; Pap, A.; Stanic, M. What Drives Organic Food Purchasing?—Evidence from Croatia. *Br. Food J.* **2018**, *120*, 734–748. [CrossRef]
63. Asif, M.; Wang, X.; Nasiri, A.; Ayyub, S. Determinant Factors Influencing Organic Food Purchase Intention and the Moderating Role of Awareness: A Comparative Analysis. *Food Qual. Prefer.* **2018**, *63*, 144–150. [CrossRef]
64. Pampuro, N.; Caffaro, F.; Cavallo, E. Reuse of Animal Manure: A Case Study on Stakeholders' Perceptions about Pelletized Compost in Northwestern Italy. *Sustainability* **2018**, *10*, 2028. [CrossRef]
65. Tur-Cardona, J.; Bonnichsen, O.; Speelman, S.; Verspecht, A.; Carpentier, L.; Debruyne, L.; Marchand, F.; Jacobsen, B.H.; Buysse, J. Farmers' Reasons to Accept Bio-based fertilizers: A Choice Experiment in Seven Different European Countries. *J. Clean. Prod.* **2018**, *197*, 406–416. [CrossRef]
66. Siepmann, L.; Nicholas, K.A. German Winegrowers' Motives and Barriers to Convert to Organic Farming. *Sustainability* **2018**, *10*, 4215. [CrossRef]
67. Gomiero, T.; Pimentel, D.; Paoletti, M.G. Environmental Impact of Different Agricultural Management Practices: Conventional vs. Organic Agriculture. *Crit. Rev. Plant Sci.* **2011**, *30*, 95–124. [CrossRef]
68. Wei, Y.D.; Ye, X. Urbanization, Urban Land Expansion and Environmental Change in China. Stoch. Environ. *Stoch. Environ. Res. Risk Assess.* **2014**, *28*, 757–765. [CrossRef]
69. Lin, J.Y. Collectivization and China's Agricultural Crisis in 1959–1961. *J. Political Econ.* **1990**, *98*, 1228–1252. [CrossRef]
70. Röös, E.; Mie, A.; Wivstad, M.; Salomon, E.; Johansson, B.; Gunnarsson, S.; Wallenbeck, A.; Hoffmann, R.; Nilsson, U.; Sundberg, C.; et al. Risks and opportunities of increasing yields in organic farming. A review. *Agron. Sustain. Dev.* **2018**, *38*, 14. [CrossRef]
71. Muller, A.; Schader, C.; El-Hage Scialabba, N.; Brüggemann, J.; Isensee, A.; Erb, K.-H.; Smith, P.; Klocke, P.; Leiber, F.; Stolze, M.; et al. Strategies for feeding the world more sustainably with organic agriculture. *Nat. Commun.* **2017**, *8*, 1290. [CrossRef]
72. Bawa, K.S.; Koh, L.P.; Lee, T.M.; Liu, J.; Ramakrishnan, P.S.; Yu, D.W.; Zhang, Y.; Raven, P.H. China, India, and the Environment. *Science* **2010**, *327*, 1457–1459. [CrossRef]
73. Kallas, Z.; Serra, T.; Gil, J.M. Farmers' Objectives as Determinants of Organic Farming Adoption: The case of Catalonian Vineyard Production. *Agric. Econ.* **2010**, *41*, 409–423. [CrossRef]
74. Szogi, A.A.; Vanotti, M.B.; Ro, K.S. Methods for Treatment of Animal Manures to Reduce Nutrient Pollution Prior to Soil Application. *Curr. Pollut. Rep.* **2015**, *1*, 47–56. [CrossRef]
75. He, Y.; Qi, Y. Empirical Study on the Formation Mechanism of Farmers' Green Production Behavior. *Jiangsu. J. Agric. Sci.* **2021**, *6*, 93–102. [CrossRef]
76. Serebrennikov, D.; Thorne, F.; Kallas, Z.; McCarthy, S.N. Factors Influencing Adoption of Sustainable Farming Practices in Europe: A Systemic Review of Empirical Literature. *Sustainability* **2020**, *12*, 9719. [CrossRef]
77. Sapbamrer, R.; Thammachai, A. A Systematic Review of Factors Influencing Farmers' Adoption of Organic farming. *Sustainability* **2021**, *13*, 3842. [CrossRef]
78. Case, S.D.C.; Oelofse, M.; Hou, Y.; Oenema, O.; Jensen, L.S. Farmer Perceptions and Use of Organic Waste Products as Fertilisers—A Survey Study of Potential Benefits and Barriers. *Agric. Syst.* **2017**, *151*, 84–95. [CrossRef]
79. Su, S.; Ma, X.; Xiao, R. Agricultural Landscape Pattern Changes in Response to Urbanization at Ecoregional Scale. *Ecol. Indic.* **2014**, *40*, 10–18. [CrossRef]