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Addressing the Differences in Farmers' Willingness and Behavior Regarding Developing Green Agriculture—A Case Study in Xichuan County, China

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Abstract: The development of green agriculture is an effective way to realize the sustainable development of agriculture, which is of great significance for guaranteeing national food security, improving the supply ability of agricultural products, promoting the healthy development of cultivated land, and realizing green development. Since the 18th National Congress of the Communist Party of China, China has proposed the establishment of a green-development-oriented agricultural support system, which intends to reverse the worsening of the agricultural ecological environment; however, in 2019, the input of agricultural chemical fertilizer still exceeded the international limit of the safe application of chemical fertilizer. In recent years, agriculture has surpassed industry to become the largest non-point source pollution industry in China, seriously affecting the rural ecological civilization construction and the advancement of green sustainable development coordinated. To analyze the key factors affecting the development of green agriculture, in this study, logistic binary regression analysis was used to measure the main factors affecting farmers' green agricultural production willingness and green agricultural production behavior. The results show that a farmer's age, land type, compensation for land transfer, technical service organization, related training, and economic and technological subsidies had significant effects on their green agricultural production willingness. The age of farmers, number of staff, risk of green agricultural production technology, technical service organization, and economic and technological subsidies were shown to have significant effects on the green agricultural production behavior of farmers, where the different factors influenced the behavior to different degrees. Based on the above findings, it is suggested that the Chinese government should help farmers to carry out agricultural green transformation through technical training, policy popularization, economic subsidies, and educational support.

Keywords: green agriculture; agricultural ecology; land survey; farmer willingness; logistic dual regression analysis

1. Introduction

As a large agricultural country, China has solved the food problem for 22% of the world's population by relying on 7% of the world's arable land, and has made great contributions to the world's food security [1,2]. Since the founding of New China, in order to ensure food security, China's agricultural development has gone through three stages of exploration. The first stage was from 1949 to 1956. China carried out land reform, and land ownership changed from private ownership to collective ownership by farmers. The second stage was from 1956 to 1978, when the land belonged to the rural commune. The third stage began in 1978 and continues to this day. After the Third Plenary Session of the Thirteenth Central Committee, the Chinese government vigorously promoted the household production contract responsibility system—an agricultural production

responsibility system in which farmers use the family as a unit to contract land and other production materials and production tasks to a collective organization. In this way, past limitations have been resolved, and grain output has increased substantially, which has led to the development of the Chinese economy [3,4]. In addition, since the beginning of the 21st century, China's rural population has migrated to cities and towns in large numbers. The high income available has attracted more and more farmers to engage in non-agricultural work in the cities. In particular, in the central and western regions of China, many agricultural laborers have left the countryside and flocked to the cities, leading to an aging agricultural labor force and agricultural operators. In this case, the traditional farming mode cannot bring about efficient agricultural production benefits. Instead, this has caused serious land waste and pollution [5,6], with the ecological production environment in many rural areas being destroyed.

In order to protect the ecological environment and ensure the healthy and sustainable development of agricultural and rural areas, the Chinese Communist Party has proposed a series of policies aimed at reversing the trend of deterioration of the agricultural ecological environment and the wastage of agricultural resources. China creatively proposed the "three rights separation" to provide a legal basis for land transfer in order to reduce the problem of land waste. At the 18th National Congress of the Communist Party of China, China proposed to establish a green development-oriented agricultural support system [7,8]. In 2017, the rural revitalization strategy was first proposed. In 2021, the first document of the Communist Party of China emphasized the promotion of the green development of agriculture and a continuous reduction in the use of fertilizers and pesticides [9,10]. However, farmers, who are "rational economic people" [11]—the most basic agricultural production and management entity in rural China—have an insufficient awareness of green agriculture, and they hope to obtain higher agricultural output through higher fertilizer inputs. The use of chemical fertilizers, pesticides, excessive chemical fertilizers, pesticides, etc., on such a large amount of farmland has caused the content of nitrogen and phosphorus elements in the water to increase, via surface runoff, etc., thereby polluting the soil and rivers, and further aggravating agricultural non-point source pollution [12–14]. Relevant studies have shown that in the 40 years since China's reform and opening up, the application of agricultural fertilizers has increased by 5.77 times. In 2019, the input of agricultural fertilizers of 326 kg/hm still exceeded the international limit for the safe application of chemical fertilizers, but the loss of utilization efficiency was as high as 60% [15,16]. At present, agriculture has surpassed industry to become China's largest non-point source pollution industry, which has seriously affected the coordinated promotion of rural ecological civilization construction and green sustainable development [14]. Therefore, the development of green agriculture is of great significance for ensuring national food security, improving the supply of agricultural products, promoting the healthy development of cultivated land, and realizing green development.

Green agriculture is an agricultural development model that promotes sustainable economic, ecological, and social development. Specifically, through the reasonable combination of field labor technology and cultivation mode with scientific production technology, we can achieve a more efficient land use mode, reduce the damage and damage of artificial cultivation to the ecological environment, and realize the sustainable and healthy use of cultivated land [17]. At present, domestic and foreign academic research on green agriculture mainly focuses on the realization of green agriculture [18,19], the theoretical analysis of green production behavior [20,21], the influencing factors of green production behavior [22,23], and the development level of green agriculture [24,25] and other aspects. Among them, Chen Weiping et al. [26] analyzed the impact of the institutional environment on farmers' willingness to transform green production based on the perspective of institutional theory. Qiao Jinjie [27] tested the intervention effect of government subsidies on green agriculture based on the modified Von Neumann utility function. Shang Yan [28] and others believe that the level of family economic development is an important factor that restricts farmers from consciously adopting green agricultural production technologies.

Yang Zhihai [29] believes that the aging trend of agricultural labor has a significant impact on farmers' green production technology adoption behavior. Kumarilp [30] believed that the level of education of farmers affects the behavior of farmers' pesticide application. Shi Zhiheng [31] analyzed the factors affecting farmers' green production willingness by constructing a research framework for farmers' willingness to engage in green production.

The above research shows that there are many factors that affect the development of green agricultural production by farmers, which not only have their own characteristics, but also contain many external factors. There are a large number of smallholder farms in China, according to statistics from China's Ministry of agriculture and rural affairs. As of 2017, there are about 260 million smallholder farms with a cultivated land area less than 3.33 ha, accounting for about 98% of the total amount of new agricultural operators. The total cultivated land area of China is about 15 million ha, of which smallholder farms account for more than 80%, and their behaviors and understanding are also very different, thereby restricting the development of green agriculture. At present, most of the existing studies focus on qualitative analysis in the macro field. Moreover, most of the studies are on farmers' consciousness, and there is a lack of comparison of the differences between farmers' willingness to adopt green production and the influencing factors of their behavior. In this paper, with reference to the previous research of domestic and foreign scholars [22,23,29], through field questionnaire surveys in typical areas of China, we obtain the relevant characteristics of farmers' willingness and behavior to adopt green agricultural production, and develop a structure that includes farmers' education, land transfer status, and government subsidies. We assess the system of influencing factors, such as internal and external factors, and conduct an empirical analysis of the influencing factors of farmers' green production behavior and willingness through binary logistic regression, so as to realize the difference between will and behavior, and put forward corresponding policy recommendations based on our conclusions. China provides a reference for formulating practical and feasible green agricultural development.

Henan Province, as one of China's main grain-producing areas, will produce 68.26 million tons of grain in 2020, and has been at the forefront of the country's grain production for many years. In 2021, the No. 1 document of the Central Committee of the Communist Party of China clearly established a pilot project for agricultural non-point source pollution in the Yellow River Basin. In addition, China's South-to-North Water Diversion Project has eased water shortages for tens of millions of people. The mid-line project originated in Nanyang City, Henan Province. Therefore, conducting research on green agriculture in Henan is of great significance to China.

2. Materials and Methods

2.1. Study Area

Henan Province is one of the main grain-producing areas in China, and it is also one of the areas with more serious agricultural pollution. In order to study farmers' green and sustainable agricultural production behavior from a micro perspective, the study selected farmers in Xichuan County, Henan Province, as the survey object. As the headwater source of the "South-to-North Water Diversion" project of China's national key water conservancy project, from 2009 to 2014, a total of approximately 170,000 people in Xichuan County have been relocated to ensure water quality and protection. The ecological environment in this area is a matter of great concern to the local government. The study was conducted in Xichuan County: we adopted the method of a structural interview and a semi-structured interview and randomly selected farmers from Shimen Village, Qili Village, Yangtian Village, Changing Village, and Mushan Village for in-depth interviews. A total of 170 questionnaires were distributed and 166 valid samples were collected for an effective rate of 97.65%. The distribution of the survey samples is shown in the Table 1 below.

Table 1. Distribution of the survey sample.

Town	Village	Number of Farmers
Lao Cheng Town	Shimen	76
	Qili	21
	Yangtian	27
	Changing	22
	Mushan	20

2.2. Theory and Methods

2.2.1. Theory

Cost–benefit theory: in the process of agricultural production, the main body of agricultural management makes the most suitable production decision according to their family situation and various other pieces of information and can make a rapid adjustment to the rise and fall of market prices to improve their productivity. From the economic point of view, farmers decide whether to adopt a technology or to what extent to use it based on direct economic interests. If the benefit of adopting a new technology is greater than the cost, farmers will adopt the technology; otherwise, they will not. The total cost of a certain agricultural technology choice includes the time and effort related to farmers' production factors and the marginal cost of choosing the agricultural production technology. Different farmers' different risk tolerances and attitudes lead to a change in the income curve.

Externality theory: externalities can be classified into positive externalities and negative externalities. The main way to solve the problem of low market efficiency caused by an externality is to internalize the positive externality in the process of agricultural production, that is, to transform the social benefits generated by the activities of economic entities into private benefits through institutional norms. The methods of externality internalization include taxation, subsidies, and agreements, that is, the government subsidizes smallholder farms who are engaged in agricultural green production to some extent in order to directly reduce the marginal cost of the green production technology adopted by farmers and incentivize them to increase its use. Moreover, the government's management of high-pollution agricultural production technology (such as straw burning or the excessive use of chemical fertilizer [15]) and farmers' environmental awareness also affect their decision-making behavior to a certain extent.

2.2.2. Methods

The dependent variables in this study were the willingness of farmers to adopt green production technology and their behavior regarding it, while the independent variables mainly included the household situation and three basic pieces of information, namely, existing cultivated land, cognition of green agricultural production, and external environment. In this study, a binary logistic model was used to analyze the influencing factors of green agricultural production [19,28]. X_1, X_2, X_3, $\ldots$, X_m are m independent variables related to the dependent variable Y. A total of N survey samples was conducted; that is, one set of data was obtained from each sampling $(X_{1i}, X_{2i}, \ldots, X_{mi})$, $i = 1, 2, 3, \ldots, n$.

The probability of $Y = 1$ in the i-th sampling can be expressed as follows:

$$P(Y = 1 | X_{1i}, X_{2i}, \ldots, X_{mi}) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X1i + \beta_2 X2i + \ldots + \beta_m Xmi)}} \tag{1}$$

The logical linear function was obtained by taking the logarithm of the ratio between the probability of the event occurrence and the probability of an event not occurring:

$$ln\left(\frac{p}{1 - p}\right) = \beta_0 + \beta_1 X_{1i} + \ldots + \beta_m X_{mi} \tag{2}$$

where β_0 is the constant term and β_1, β_2, $\ldots$, β_m represent the influence of each independent variable on the dependent variable.

2.2.3. Variable Setting

Based on the cost–benefit theory and externality theory, the influencing factors of farmland ecological security were divided into four aspects: the basic situation of farmers' household, the basic situation of the land owned by the farmers, the cognition of agricultural land ecological security, and the external environment. Four to six indicators were selected for each aspect (Table 2).

Table 2. Variables and assignments.

Variable	Variable Name	Assignment Statement
Dependent variable	The willingness of farmers to carry out green agricultural production (Y)	Yes = 1, No = 0
	Age (X_1)	Years
Household situation	Number of family members (X_2)	0–3 = 0, >4 = 1
	Number of workers (X_3)	0–2 = 0, >3 = 1
	Education level (X_4)	Junior school = 0, high school and above = 1
	Annual family income (X_5)	10,000 and below = 0, 10,000 and above = 1
	Proportion of agricultural income (X_6)	50% and below = 0, 50% and above = 1
Basic information regarding the land	Existing land types (X_7 *)	Mountain land = 2, river land = 1, abandoned land = 0
	Cultivated land area (X_8)	0.667 ha and below = 0, 0.667 ha and above = 1
	Fertilizer for cultivated land (X_9 *)	Chemical fertilizer = 0, human and animal feces = 1, organic fertilizer = 2, compound fertilizer = 3
	Procedures for the contracted land (X_{10} *)	Private agreement = 0, print by hand = 1, signing at village committee = 2, formal contract = 3
	Compensation for land transfer (X_{11} *)	No compensation = 0, minor compensation = 1, full compensation = 2
Internal factors of ecological security cognition	Treatment of residues in the field (X_{12} *)	In situ incineration = 0, take it home for fuel = 1; feeding livestock = 2, straw returning = 3
	Attitude regarding the policy of returning farmland to the forest (X_{13} *)	Supportive = 0, listen to the government = 1, very supportive = 2, supportive but need benefits = 3
	Willingness regarding agricultural technology (X_{14})	Strong = 1, weak = 0
	Green production has economic benefits (X_{15})	Agree = 1, disagree = 0
	Green agricultural production risk (X_{16})	High = 0, low = 1
	Benefits of green agricultural production (X_{17})	No benefit = 0, benefit = 1
External factors of ecological security cognition	Agricultural technical service organizations (X_{18})	Yes = 1, no = 0
	Training (X_{19} *)	Yes = 1, no = 0, not sure = 2
	Whether the government has economic and technical subsidies (X_{20} *)	Neither = 0, economic benefits only = 1, technological help only = 2, both = 3
	Government influence (X_{21})	Yes = 1, no = 0

Note: * indicates that the independent variable is converted to the dummy variable via logistic regression.

(a)　The basic situation of working-class households: this included not only the characteristics of human capital, but also the characteristics of household production. The selected household survey included six indicators: the number of family members, the number of family members in the labor force, the education level of the farmers, the annual family income, and the proportion of agricultural income. It was assumed that the number of staff in agricultural production and management and the education level of the farmers had a significant impact on the adoption behavior of agricultural technology. Generally speaking, the more dependent farmers were on agricultural

income, the higher their enthusiasm for agricultural production, and they were more willing to adopt more efficient farmland technology and receive more agricultural technology training. Moreover, the difference in the individual education level made the learning ability of farmers vary greatly [27]. People with weak learning abilities generally struggled to use new technology.

(b) The basic situation of the farmers' existing land: the questionnaire covered five indicators, including the types of the farmers' existing land, the existing land area, the types of fertilizer used in the cultivated land, the procedures for signing land contracts, and the compensation for land acquisition. These basic factors regarding land conditions help to understand the implementation of some basic policies in rural areas and the basic status of cultivated land, and they provide basic data for the formulation of land policies.

(c) Agricultural land ecological security awareness: in this case, six indicators were examined, including the treatment of farm residues, attitude regarding the policy of converting farmland to forests, green technology learning ability, the economic benefits of green production technology, the risk of green production technology, and the benefits of green agricultural production technology. In the process of farmers' decision-making regarding production, whether economic benefits can be achieved is the most critical factor. The greater the risk of green technology adoption, the lower the willingness of farmers to use it [32]. Additionally, in the process of using green agricultural production technology, the benefits of farmers have a great impact on their decision-making, and the degree of their understanding of green production technology directly affects their decision-making attitude [33]. The basic attitude of farmers to green products is indicated by their attitude toward the policy of converting farmland to forests.

(d) External environment: this included four indicators, namely, whether there were green agricultural technology service organizations in towns, whether farmers had received green agricultural technology training, whether the government provided technical and economic support, and the impact of government subsidies on green agriculture. Access to agricultural technology had a direct impact on farmers' attitude toward the adoption of new technologies and relevant service agencies strengthened farmers' awareness of agricultural production technology [34]. When the environment of agricultural production was damaged, farmers' ability to accept green technology was increased, and the government's subsidies and institutional norms played a guiding role in the decision-making by farmers regarding green production.

2.2.4. Data Progressing

We used SPSS19.0 to process the collected questionnaire data. Firstly, the data were checked for outliers, and then the collinearity of each independent variable was diagnosed, and no collinearity was found (VIF (variance inflation factor) < 5). Then, the data were logistically regressed using SPSS version 19.0. In the first step, all independent variables were included in the model, and model 1 was obtained via the overall regression. In the second step, the backward LR method was used to regress the model until all variables in the model were significant, thereby leading to the creation of model 2. The accuracy of model 2 is higher than that of model 1. The chi square test and prediction accuracy obtained from the overall regression of the model determine that the model is effective. The specific results are shown in Tables 3 and 4.

Table 3. Descriptive statistics of the surveyed participants.

Variable	Classification	Number	Percent	Variable	Classification	Number	Percent
Age	[30,40)	28	16.9%	Attitude	Very satisfied	54	32.5%
	[40,50)	60	36.1%		Medium	76	45.7%
	[50–60)	50	30.1%		Not satisfied	13	7.8%
	[60,∞)	28	16.7%		Need subsidy	23	13.8%
Educational Level	Primary school	32	19.2%	Will to engage in sustainable agriculture production	Yes	104	62.6%
	Junior school	84	50.6%		No	62	37.3%
	High school	34	20.4%	Sustainable agricultural production	Yes	98	59.0%
	Above	16	9.6%		No	68	40.9%
Proportion of agricultural income	[0,30%)	58	34.9%	Sustainable agricultural production with economy benefit	Very satisfied	67	40.3%
	[30%,50%)	57	34.3%		Satisfied	70	42.1%
	[50%,80%)	23	13.8%		Dissatisfied	22	13.2%
	[80%,∞)	28	16.8%		Very dissatisfied	7	4.2%
Cultivated land area (ha)	[0,0.333)	85	51.2%				
	[0.333,0.667)	39	23.4%				
	[0.667,∞)	42	25.3%				

Table 4. Regression results of the logistic model.

Variable	Model I (Enter)			Model II (Backward LR)		
	Coefficient	Wald	EXP(B)	Coefficient	Wald	EXP(B)
X1	−0.147 ***	12.779	0.864	−0.163 ***	25.371	0.849
X2	−0.461	0.372	0.631			
X3	−0.135	0.025	0.874			
X4	0.503	0.585	1.653			
X5	0.776	1.102	2.173			
X6	−0.610	0.745	0.543			
X7	−1.320 *	3.675	0.267	−1.498 **	6.533	0.224
X8	−0.257	0.100	0.773			
X9	−3.579 **	6.111	0.28			
X10	1.830	2.268	6.236			
X11	−2.534 ***	9.447	0.079	−2.120 ***	11.107	0.120
X12	−0.714	1.269	0.489			
X13	−1.532	1.143	0.216			
X14	−0.287	0.222	0.751			
X15	2.078 **	4.901	7.987	2.131 ***	8.289	8.420
X16	0.065	0.011	1.067			
X17	0.110	0.033	1.116			
X18	1.723	2.605	5.604	1.695 **	3.914	5.446
X19	3.704 **	5.953	40.611	2.965 **	4.646	19.388
X20	−2.887 **	6.401	0.056	−2.357 ***	7.332	0.095
X21	−0.352	0.272	0.703			
constant	4.940	3.239	139.709	5.381	7.995	217.282

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

In model II, the backward LR method was used for the stepwise regression, excluding other insignificant factors, and the analysis results were more reliable. The results are analyzed by model II.

3. Results

3.1. Descriptive Statistics

The respondents were small and medium-sized agricultural growers in mountainous areas. At present, 68.0% of the contracted land is in mountainous areas, 22.2% is on river land, and 9.6% is abandoned land. The proportion of contracted land less than 0.333 ha, 0.333–0.67 ha, and more than 0.667 ha is 51.2%, 23.4%, and 25.3%, respectively. Most of the respondents in this survey were middle-aged and elderly farmers who received a basic

education. Among them, 69.8% of the farmers received education up to junior high school or below, and 30.1% up to senior high school or above. Additionally, in terms of the age distribution, the age of the respondents was mainly between 40 and 60 years old, meaning that the participants were generally middle-aged and elderly people.

In the survey, 4.8% of the farmers used chemical fertilizer, 27.7% used organic fertilizer, 61.4% used compound fertilizer, and 6.0% used human and animal manure. Regarding dealing with field residues, 46.3% of the farmers treated the residues, 10.8% of them fed the residues to livestock, 1.8% of them used in situ burning, and 40.9% of them were taken home for fuel. Straw was returned to the field or taken home for use as fuel.

According to the survey data, 85.5% of farmers knew that there were green agricultural production technology service organizations in their villages and towns, but only 57.8% received guidance and training related to agricultural green production technology.

3.2. Regression Result

3.2.1. Farmers' Willingness to Produce Green Agriculture

The overall results of the model showed that seven variables passed the 10% significance level test (Table 4), and other variables failed the significance test, indicating that they did not have a significant impact on farmers' willingness to choose sustainable production.

(a)   In terms of the influence of the factors of the family situations of the farmers, among the farmers' age, education level, annual household income, and the proportion of agricultural income in the total household income, only the age of the head of the household passed the significance test and the regression coefficient sign of the age of the head of household was negative, meaning that it had a significant negative impact. That is, the older the farmer, the lower the ability to accept agricultural green production technology. At present, China's agricultural technology is constantly being updated and improved, and this improvement in technology requires more young people to learn how to use it. However, the age of rural farmers in China is generally high and the education level is generally low, which leads to poor learning ability regarding agricultural production technology and the ability to learn new things in general.

(b)   In terms of the influencing factors of the basic situation of farmers' existing land, the type of land owned by farmers and the related compensation situation of farmers after land acquisition passed the significance test, the impact sign of river land in the land owned by farmers was negative, and the sign for all compensation given according to the national policy was positive. According to the data, the river land in the Danjiangkou Reservoir area is the land below the limit of maximum water fluctuation, which is likely to be submerged at any time. Farmers were not willing to implement more land-use technology and invest more energy if their income is not guaranteed. The compensation situation of farmers after land acquisition determined the attitude of farmers regarding adopting new technology in farming land.

(c)   In terms of farmers' cognition of ecological security, the economic benefits of green agricultural production passed the significance test, and the sign was positive. The more farmers agreed that the technology had economic benefits, the more they were willing to adopt the technology.

(d)   In the external environment, whether the township had a green agricultural technology service organization, whether it received relevant training, and whether the government provided economic subsidies and technical assistance passed the significance test, and the signs were positive. These factors indicated that the more help and economic support the government provided, the more training farmers received and the more willing they were to change production techniques.

3.2.2. Analysis of Green Agricultural Production Behavior of Farmers

The overall results of the model showed that four variables passed the 10% significance level test (Table 5), and other variables failed the significance test, indicating that

they did not have a significant impact on whether to adopt sustainable agricultural production behaviors.

Table 5. Regression results of the logistic model.

Variable	Model I (Enter)			Model II (Backward LR)		
	Coefficient	Wald	EXP(B)	Coefficient	Wald	EXP(B)
X1	−0.026	12.779	0.864	−0.045 **	4.914	0.956
X2	0.573	0.372	0.631			
X3	−1.941 ***	0.025	0.874	−1.118 **	5.647	0.327
X4	0.562	0.585	1.653			
X5	0.086	1.102	2.173			
X6	−0.473	0.745	0.543			
X7	1.007	3.675	0.267			
X8	−0.252	0.100	0.773			
X9	−0.817	6.111	0.28			
X10	−0.209	0.069	0.812			
X11	−0.549	0.215	0.577			
X12	0.079	0.025	1.082			
X13	−1.259	2.159	0.284			
X14	0.175	0.143	1.191			
X15	0.820	1.436	2.270			
X16	−0.730	2.164	0.482	−0.784 **	3.869	0.456
X17	−0.149	0.091	0.861			
X18	0.785	1.217	2.191	1.467 **	6.208	4.338
X19	2.034	2.215	7.644		4.646	19.388
X20	−1.615 **	4.347	0.199	−2.357 ***	7.332	0.095
X21	0.580	1.338	1.786			
constant	0.611	0.080	1.842	2.392	4.129	10.938

Note: ** and *** indicate significance at the 5% and 1% levels, respectively.

Among the influencing factors of the household conditions, the age of the farmers and the number of workers in the labor force in households passed the significance test, and the signs of the regression coefficients were negative. The older the farmer, the lower the ability to accept agricultural green production technology and the lower the probability of utilizing green agricultural production technology. The impact of the number of the rural household labor force was negative, indicating that the higher the number of the rural household staff the more extensive the agricultural production behavior and the lower the willingness to accept the refined agricultural production behavior.

Only the risk of green agricultural production technology passed the significance test, and the sign was negative, which means that it had a significant negative impact. This shows that the lower the risk, the higher the utilization of green agricultural production; farmers will generally consider the risk of this technology when they use new agricultural production technology.

Among the external influencing factors of farmers' cognition of ecological security, whether the township had a green agricultural production technology service organization and whether the government provided economic subsidies and technical support when implementing green agriculture passed the significance test, and the signs were positive, showing significant positive impacts. The more organizations of green agricultural production technology service, the more extensive the willingness of farmers to carry out green agricultural production, because high-quality technical support and service enhance the enthusiasm of farmers to learn how to use new technology. The more sufficient the economic subsidies and technical training provided by the government, the more farmers can learn about and improve their utilization of agricultural production technology.

4. Conclusions and Discussion

4.1. Discussion

After analyzing the willingness to engage in green agricultural production and the green agricultural production behavior of farmers, only the age of farmers, whether there was a technical service organization in the township, and whether the government provided economic subsidies and technical assistance, had an impact on both. The other factors were independent of each other. The results show that the age of farmers had a great impact on the improvement and development of agricultural production technology, and the age of farmers limited the development of agricultural green technology to a large extent. It is common for farmers to be reluctant to change their production model [35]. It will take a certain amount of time and processing for the production activities of rural basic agricultural operators to change from the current high-input and high-pollution production mode to green agricultural production [19,36]. At present, China's agricultural technology is constantly being updated and improved, and this improvement in technology requires more young people to learn how to use it. However, the age of rural farmers in China is generally high and the education level is generally low, which leads to a poor learning ability regarding agricultural production technology and the ability to learn new processes in general.

In today's rural social development process, the government should formulate specific training and assistance policies for rural elderly people to help farmers better understand green agricultural production technology and methods for utilizing it. According to the distribution area and the number of households in rural areas, green agricultural technology service organizations should be established. When farmers encounter difficult problems, they can go to the nearest help station, where their problems can be solved promptly. Only when their problems are solved promptly will the willingness of farmers to carry out green production be higher. In the implementation of green agricultural production, when farmers learn about new technologies, appropriate economic subsidies from the government can also stimulate enthusiasm. Economic subsidies provided by the government have a better incentive effect than the government's mandatory requirements. The government fully protects the interests of farmers, which provides farmers with a high willingness to accept the policies [37].

In summary, unlike most studies, in which researchers only consider one aspect, we took both farmers' green agricultural production behavior and willingness into consideration. After analyzing the influencing factors, we discussed the differences between them. In the future, we will follow the principle of consistency of "willingness and behavior" to further analyze the influencing factors of the green production behavior of farmers alongside their green production willingness.

4.2. Conclusions

This study analyzes survey data on farmers in Xichuan County, Henan Province in 2019, takes into account the external environmental conditions of sustainable agricultural production, combines farmers' perceptions of sustainable agricultural production and farmers' own characteristics, and uses binary logistic regression to analyze farmers' behavior regarding sustainable agricultural production, as well as the influencing factors. The following conclusions can be drawn:

(a) In the analysis of farmers' willingness to utilize green agriculture, the age of farmers shows a significant negative impact. The level of education received by farmers and the government's economic compensation after the land is expropriated all have a significant positive effect on farmers' willingness to engage in green production.

(b) In the analysis of farm households' green agricultural production behavior, the age of farm households and the number of family laborers present a significantly negative impact. On the other hand, the risks associated with green agricultural production technology, whether the town has a green agricultural production technical service

(c) organization, and the government implementing green agriculture economic subsidies and technical support present a significantly positive impact.

(c) Although a considerable proportion of farmers maintain a positive attitude towards sustainable agricultural production, they are limited by their economic level, insufficient knowledge reserves, and insufficient ability to control risks. In the actual production process, the proportion of farmers adopting green agriculture is not high, which is in line with the hypotheses of "rational economic people".

(d) According to the results and the current development level, the government should strengthen subsidies for green agricultural production, so as to encourage farmers to implement green production behavior. It is necessary to strengthen the publicity of green agriculture to improve farmers' awareness of green agricultural production [37]. In addition, studies in Mongolia and Turkey also show that land scale, education level, and agricultural technology training all have a significant impact on farmers' green production willingness [38,39]. Therefore, it is necessary to strengthen the agricultural production technology training for farmers, let farmers master scientific and green production technologies, and reduce the risk of agricultural technology, so as to increase farmers' income. In addition, we should develop the family farm model with family as the unit, actively promote land circulation, and develop an intensive scaled operation.

The results of this study can provide a reference and the basis for researchers and government decision-makers to implement changes. In addition, the variables selected and methods used in this study can be used in similar areas.

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