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The Relationship between Land Transfer and Agricultural Green Production: A Collaborative Test Based on Theory and Data

Dungang Zang, Sen Yang and Fanghua Li *

College of Economics, Sichuan Agricultural University, Chengdu 611130, China
* Correspondence: lfhua@stu.sicau.edu.cn

Abstract: Under the background of tighter resource and environmental constraints, whether and how land transfer can promote the green development of agriculture has become a realistic question that needs to be answered urgently. This paper analyzes the internal mechanism between land transfer and agricultural green production by using property rights theory and sustainable development theory. Taking the data of the "investigation on household energy consumption and green agricultural development" in Sichuan Province in 2022 as a sample, it empirically analyzes the impact of land transfer on agricultural green production by using OLS and 2SLS models. The results show that: (1) land inflow significantly improves the level of agricultural green production, with a unit impact of 22.3%; (2) whereas land outflow will inhibit agricultural green production, with a unit impact of 5.46%; (3) the family's long-term agricultural labor, social capital, migrant experience, non-agricultural income, and household clean energy use have a promoting effect on agricultural green production; (4) age, education level, health level and agricultural subsidies inhibit agricultural green production; (5) the heterogeneity analysis found that the inflow of land would significantly promote the level of green agricultural production of farmers who have environmental awareness, have been village cadres, have purchased agricultural insurance, and have not suffered from agricultural disasters; (6) agricultural training, farmers' digital literacy, and agricultural related loans have a positive and strengthened regulatory role in the impact of land transfer on agricultural green production. Based on this, this paper gets policy enlightenment from the government, market, and farmers.

Keywords: land transfer; agriculture; green production; property rights theory; sustainable development theory

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1. Introduction

Green agriculture is an effective way to achieve sustainable agricultural development. It is of great significance to ensure national food security, improve the supply capacity of agricultural products, promote the healthy development of arable land, and achieve the sustainable development goals of the United Nations [1,2]. Promoting green agricultural development and promoting the profound transformation of agriculture from "quantity" to "quality" are the inevitable choice for comprehensively implementing the development concept of green agriculture and achieving the goal of food security, and the objective requirement of the development of agriculture itself [3]. As the decision-maker and executor of agricultural green production, the "greening" of farmers' production behavior is the key to agricultural green development. After more than 50 years of development of world agriculture, the regional concentration of agricultural production has greatly increased. Although the production modes of different places are different, the core is the substantial increase in agricultural total factor productivity [4], green agricultural production is the development trend of world agriculture, and family farms are the final option for world agricultural development [5]. However, at present, China's agricultural operation is characterized by concurrent operation and small-scale decentralization, and the green production willingness and production capacity of small farmers under this operation form are generally not high [6]. How to scientifically and reasonably guide and drive farmers (especially small farmers) to engage in or indirectly engage in green production has become the core of promoting agricultural green development [7].

Agricultural green production refers to a new production mode that aims at reducing consumption, energy conservation and emission reduction, is characterized by reducing factor input and increasing output efficiency, adopts large-scale, professional and green production behaviors [8], and ultimately realizes resource conservation, pollution reduction, output efficiency and sustainable development [9,10]. In this paper, the agricultural green production behavior of farmers mainly refers to the behavior that farmers pay attention to resource conservation (waste recycling), environmental protection (pollutant treatment methods, use of clean energy), green agricultural product production (use of green fertilizer) and so on in the process of agricultural production. Farmers' green production can not only improve the rural ecological environment but also improve the quality of arable land, with considerable environmental and economic benefits [11,12]. The green development of agriculture based on this is not only an inevitable requirement to improve the competitiveness of agricultural products in the international market, but also an objective requirement of the severe situation of water and soil resources quality [13]. A survey data of farmers from Xinjiang, China, proved that behavioral attitudes, subjective attitudes, behavioral norms and perceived benefits can promote farmers' agricultural green production [14]. Investment risk expectation, policy cognition level and agricultural subsidy satisfaction also have an incentive effect on Farmers' participation in agricultural green production [15]. At the same time, scholars found that the urbanization development has a significant positive effect on the agricultural green production efficiency, and the urbanization development of adjacent prefecture level cities has a positive spillover effect on the agricultural green production efficiency of the city [16]. Village regulations and formal environmental regulations are also of great significance for regulating farmers' clean production behavior, promoting green transformation of agriculture, and achieving sustainable agricultural development [17]. The use of green agricultural production technology can not only alleviate the degradation of soil fertility but also improve the agricultural productivity of small farmers. Further analysis shows that compared with small-scale farmers, large-scale farmers are more likely to adopt green production technology [18]. The above has explained the impact of labor, production technology, social environment and systems and regulations on agricultural green production. What impact will land, as one of the production endowments, have on it? This is also one of the hotspots in the current discussion on the influencing factors of agricultural green production.

There are two main reasons why land has become one of the important productive Livelihood Assets of rural families in developing countries: first, it is used as an input for agricultural production, which is one of the main sources of income for rural families. Second, land can be used as collateral for production activities and other needs to borrow money or raise capital [19]. Land ownership rights, tenure and transfer methods are of vital importance to productivity, equity, welfare, market integration, economic diversification and growth [20]. At present, there are mainly four viewpoints on the impact of land transfer and agricultural green production: first, clear property rights can protect farmers' land transaction rights, so that farmers can freely allocate resources within their power to maximize their own profits [21]. This kind of income also brings more investment space to farmers, which further urges them to produce in a green way. Second, a stable land ownership relationship can reduce the loss of agricultural investment, thereby increasing the expected income of farmers, driving farmers to expand their long-term investment, and stimulating farmers to adopt green production technologies, especially for farmers with relatively large production scale [22]. At the same time, green agricultural technology will also bring trans period benefits to farmers [23]. Therefore, when the property rights of agricultural land are more stable, the risk of farmers recovering long-term investment is also reduced. Third, the quality of land transfer is the key to encourage large-scale farmers to apply organic fertilizer [24]. Moreover, participation in the land transfer market with guarantee will have a greater green driving effect on small farmers with poor endowment in green production technology, small-scale and part-time industry [25,26]. Fourth, clear land property rights can affect mortgage loans. The stability of land rights can clearly delineate land ownership, which can be used as a bargaining chip for mortgage loans, making farmers more likely to use arable land as a guarantee for obtaining agricultural credit [27], thus further promoting green agricultural production.

According to China's demographic data released by the National Bureau of statistics, the number of rural populations in 2019 was 551.62 million, accounting for 39.4%. Such a huge volume determines the importance of "three rural" issues in China's cause [28]. However, China's "three rural" issues have always been closely related to "land". According to the land transfer market report released by tuliu.com, the largest comprehensive service platform for land transfer in China, in 2018, the number of agricultural land information released in January alone reached nearly 150,000 and continued to explode. The traditional transfer and lease methods accounted for 51% and 38% respectively, which are still the mainstream form. In January 2019, the government further improved the laws, regulations and policy system for implementing collective ownership, stabilizing farmers' contracting rights, and liberalizing land management rights in the opinions on adhering to the priority development of agriculture and rural areas and doing a good job in the work of "three rural issues". In the field of green agriculture, in 2003, China first proposed the concept of green agriculture. After this, government departments began to explore and develop green agriculture in large quantities. Up to now, there are mainly five agricultural green production modes in China, "rice +", "wheat +", "green production mode of planting and breeding cycle", "green production mode of fruit" and "green production mode of tea" [29]. Different research teams have built perfect green agricultural production systems [30] and have made deep use of the motives and influencing factors of agricultural green production behavior [31]. At the same time, there are also a variety of agricultural green production efficiency evaluation systems and evaluation methods, and green agriculture is booming in China. This information shows that whether it is agricultural green production or land transfer, there is a large market space and relevant data in China, so it is reasonable and valuable to use the data of Sichuan Province in China to study the relationship between the two.

The existing literature has important reference significance. Most of the literature focuses on the study of farmers' willingness to adopt green production technologies and the influencing factors of their adoption behavior. However, China's agricultural land is scattered into hundreds of millions of small farmers' contracted land, which makes the land transfer of small farmers the prerequisite for large-scale operation of agricultural land, and large-scale operation can promote the development of green agriculture to a large extent, Therefore, it is very valuable to study the relationship between land transfer and agricultural green production. Based on the above, this paper may have the following three contributions. First, the research perspective is unique. Based on the study of land transfer, through the heterogeneity analysis of farmers, it can more clearly show the acceptance of different farmers for land transfer; Second, through the adjustment effect test, some key factors that can promote the relationship between land transfer and agricultural green production are found, which have more possibilities for agricultural green development; Third, through the corresponding theoretical and empirical analysis, enrich the relevant literature, and draw the corresponding policy enlightenment. The rest includes theoretical analysis (Section 2), data and methods (Section 3), empirical analysis (Section 4), further regulatory effect analysis (Section 5), and discussions, conclusions and policy recommendations (Section 6).

2. Theoretical Analysis

Property rights theory points out that unstable property rights will prevent farmers from making long-term investments [32]. In contrast, relatively stable agricultural land property rights can improve farmers' expectations for the future, thereby stimulating them to carry out green production [33]. The theory of sustainable development extends to the field of agriculture and rural economic development, that is, it forms the theory of sustainable agriculture. The sustainable utilization of resources is the core of the strategy of sustainable development [34]. In this paper, it mainly refers to the sustainable utilization of agricultural land resources, which is the key to achieving the allocation of production factors and promoting the sustainable development of agriculture [35]. The transfer of agricultural land will affect the green production behavior of farmers from three aspects, thus affecting the sustainable development of Agriculture:

First, trading earnings will have an impact. Property rights stimulate farmers to adopt green production technologies by promoting transactions and reducing uncertainty [36], and only relying on green and efficient technologies can truly achieve sustainable agricultural development [37]. Among them, the implementation of the land transfer trust mechanism has effectively promoted the green development of agriculture, and a variety of financing methods have made it possible to expand the scale of agricultural development, which has also reduced the cost of agricultural production to a certain extent [38]. Land transfer can not only improve the possibility of trusteeship farmers with green production intention to engage in green production, but also introduce green production factors to trusteeship farmers with productive service needs but no clear green production intention and drive the transformation of agricultural production mode of farmers without green production intention [3]. Compared with non-tradable land, officially transferred agricultural land is more stable and tradable, so the effect of agricultural land transaction income can encourage farmers to invest more in agricultural land and stimulate their green production [39,40]. Stable land ownership is conducive to farmers' participation in the agricultural land transfer market, thus improving the allocation of agricultural means of production through the market mechanism. This in turn increases the possibility for farmers to realize the value of farmland investment, thus stimulating them to make long-term investment and adopt green agricultural technology. The quality of land transfer is the key to encourage large-scale farmers to apply organic fertilizer [24], and ultimately achieve the sustainable use of land resources [41]

Secondly, agricultural land transfer affects farmers' green production behavior through direct incentive effect. The contract theory believes that a stable contract can stimulate farmers' long-term investment by increasing farmers' expected income [42]. Stable agricultural land property rights have a significant incentive effect on farmers to increase long-term investment. In contrast, unstable agricultural land property rights increase the risk of long-term agricultural land investment and reduce the stability of farmers [43]. As a result, their confidence in getting a return from any long-term investment decreases, which reduces their motivation to make long-term investments in agricultural land [35]. Therefore, although the future return of the green production mode may be higher, when farmers predict that it is difficult to realize the value of farmland investment, they will avoid the green production mode to reduce the loss of farmland investment return [44]. The theory of sustainable development will supplement this confidence for farmers. The use of green agricultural production technology can not only improve the agricultural productivity of small farmers but also alleviate the degradation of soil fertility and realize the sustainable use of agricultural land resources [18], this will stimulate farmers to transfer land to form scale benefits and meet some restrictions on the use of green technology for production.

Finally, mortgage loans. Unstable property rights tend to underestimate the value of agricultural land. Such a low valuation makes farmland mortgage loans unattractive to both borrowers and lenders. Stable land rights can also improve farmers' ability to obtain credit by mortgaging their farmland management rights, which helps to provide adequate agricultural credit funds for agricultural production and improves their ability to make long-term investment in land [40]. For China, at present, the rural population is facing the problem of aging, which may lead to the shortage of labor in some small peasant households. However, this problem in turn will promote the transfer of land to peasant households with sufficient labor, and at the same time, it will also be accompanied by the improvement of the level of agricultural machinery, which will further affect the long-term investment rate of agricultural land and achieve the sustainable utilization of agricultural land resources [45]. The long-term investment in land will certainly change from a small-scale and decentralized management model to a new type of agriculture with scale benefits. At the household level and the plot level, there is a stable inverse "U" relationship between the land management scale and the implementation of environmentally friendly production behavior by farmers. Appropriately expanding the land scale is conducive to the green production behavior of farmers, such as returning straw to the field [46,47], thus promoting the green and sustainable development of agriculture.

3. Materials and Methods

3.1. Data

This paper uses the data of "investigation on household energy consumption and green agriculture development" in Sichuan Province in 2022. This survey collected basic personal and family information, agricultural (animal husbandry) production and health data of residents of agricultural (animal husbandry) villages in Sichuan Province. 600 questionnaires were actually distributed, 523 questionnaires were recovered, and 498 were effective, accounting for 95.22%. First, we tested the reliability and validity of the survey data. The reliability test value is Cronbach-α = 0.801, validity test value KMO = 0.776, indicating that the questionnaire data is reliable; Secondly, according to "which of the following crops are grown in your family?" And "which of the following livestock (poultry) do you raise?" For the two questions, the sample data of "not planted" and "not cultured" are selected at the same time; then, this paper eliminates the extreme values in the data, fills in the missing values, and normalizes the data; finally, a total of 454 valid sample data are obtained for empirical analysis. Figure 1 shows the research area and sample distribution of this paper.

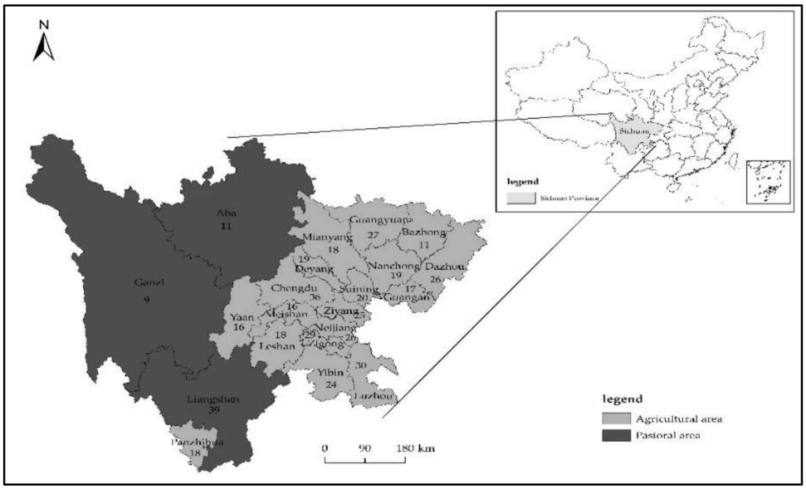

Figure 1. Study area and sample distribution. Note: The numbers in the figure, such as "Chengdu 36", represent 36 sample data from Chengdu. Source: painted by Fanghua Li and it does not involve copyright conflict.

3.2. Variables

3.2.1. Explained Variables: Green Production in Agriculture (GPA)

Explained variable. The variable to be explained in this paper is the agricultural green production level of the producing farmers, which is measured by the calculated green production index. With reference to the research of Sun and Liu (2019) [3], according to the changes in the use of biological fertilizers (green fertilizers), chemical fertilizers, pesticides, mulches and mechanical fuels in agricultural production of households in the past three years; the main methods of disposing mulch wastes in households and straw in agriculture and animal husbandry; the subjective weighting method is used to select data from seven questions, and then the green production index is calculated using the principal component analysis and factor analysis models to measure the level of agricultural green production. These indicators can cover the planting, harvesting, waste recovery and treatment processes in the agricultural production process, which are basically the indicators shared by every production farmer. Therefore, selecting the above as the measurement standard can reflect the green production level of farmers more comprehensively.

3.2.2. Explanatory Variables: Land Transfer (LT)

The core explanatory variable. The explanatory variable of this article is land transfer. In this article, it is divided into two indicators: Land inflow and land outflow. As an important way to connect traditional agriculture with new agriculture, land transfer has developed to most provinces of the country, with a service area of hundreds of millions of mu. While solving the problem of "who will plant the land", it also introduces green production factors into agriculture and promotes agricultural green production. Therefore, this paper uses whether the family abides by the land transfer policy (rent in or rent out) to measure whether there is land inflow or outflow.

3.2.3. Control Variables (CV)

Control variables. This paper selects the personal characteristics of the head of household (age, gender, marital status, physical health level, education level, social capital, whether he works abroad), the characteristics of the head of household (the number of long-term agricultural labor force in the family, family agricultural subsidies, total family income, and the use of clean energy in the family) Social characteristics (whether the village develops non-agricultural economy or not) are the control variables that affect farmers' land transfer and green production behavior. Affected by such factors as age, gender, marital status, physical health level, education level, social capital, and whether to work abroad, the heads of households in different situations will put different labor into production according to the labor law, and there will be differences in the cognition of land transfer. Naturally, there will be differences in whether to carry out land transfer and green production behavior. At the same time, agricultural production decision-making is a family decision-making behavior, which is naturally affected by family characteristics. The number of long-term labor force of a family determines how large an area of agricultural production a family can bear. Agricultural subsidies and total household income will affect the ability to pay for some agricultural production factors, as well as land transfer and agricultural green production. Finally, whether the village develops a non-agricultural economy also reflects whether farmers have other large amounts of non-agricultural income, which will affect agricultural production and lead to land transfer. All the variables selected in this paper are reported in Table 1.

Table 1. Variable selection and definition.

Variables Type	Variables	Define
Explained variables.	Green production in agriculture (GPA)	According to "Has your household's fertilizer (B09), pesticides (B11), mulche s(B14) and mechanical fuel (B23) use in agricultural production increased, decreased or remained more or less the same in the last 3 years? a = increased = −1, b = remained unchanged = 0, c = decreased = 1; What are the main methods of disposal of waste mulch in your household? (B13) a = buried in situ = −1, b = open burning = −1, c = harmless disposal = 1; What are the main methods in which your household handles straw in farming and livestock production? (B15) a = straw return to the field (land) = 1, b = open burning = −1, c = for domestic indoor fuel = −1, d = processed as livestock feed = 1, e = processing and cultivation of edible mushrooms = 1; Has the amount of biological manure (green fertilizer) used in your household increased, decreased or remained more or less the same in the last 3 years? (B18) a = increased = 1, b = remained unchanged = 0, c = decreased = −1". Using a subjective weighting method, we selected data from 7 questions and set "1 = green production, 0 and −1 = non-green production", then the green production index was calculated using principal component analysis and factor analysis models to measure the level of agricultural green production.

Table 1. *Cont.*

Variables Type	Variables	Define
	Green production in agriculture (GPA_2)	According to "Does your household use chemical fertilizers (B08), pesticides (B10), mulches (B12), mechanical fuel (B22) in agricultural production? a = Yes, b = No; Does your household use green manure in agricultural production? (B17) a = Yes, b = No; Has your household expanded agricultural land area by clearing woodland or grassland? (B27) a = Yes, b = No." Reassign options of B08, B10, B12, B22 and B27 to "b = green production behavior = 1, a = non-green production behavior = 0" and option B17 to "a = green production behavior = 1, b = non-green production behavior = 0"; Then sum up each household's green production behavior score for each household to measure AGPB.
Explanatory variables	Land rent in (LRI)	Does your household rent in land according to the land transfer policy? 1 = Yes, 0 = No.
	Land rent out (LRO)	Does your household rent out land according to the land transfer policy? 1 = Yes, 0 = No.
Control variables (CV)	Age	How old are you? (Unit: years)
	Gender	1 = Male; 2 = Female.
	Marriage	1 = Unmarried; 2 = Married; 3 = Divorced; 4 = Death of wife/husband.
	Education	Respondents' educational level is: 1 = Illiterate; 2 = Primary school; 3 = Junior high school; 4 = High/vocational school; 5 = Undergraduate/polytechnic; 6 = Master/doctor.
	Health	What do you think of your health? 1 = very poor; 2 = poor; 3 = fair; 4 = good; 5 = very good.
	Social capital (SC)	How many good friends do you have in your local area? 1 = 0, 2 = 1~3, 3 = 4~7, 4 = 7+
	Number of agricultural labors (AL)	How many people in your household are permanently involved in agricultural or pastoral production?
	Agricultural subsidy (AS)	How much was your household's agricultural subsidy last year in approximately RMB? (Agricultural subsidy). *Ln* (agricultural subsidy).
	Experiences of work outside (EWO)	Have you worked outside the home in the last 3 years? 1 = Yes; 0 = No
	Non-agricultural production income (NAPI)	What was your household's total income last year in approximately RMB? (Total household income); What was your household's agricultural production income last year in approximately RMB? (Agricultural production income). *Ln* (Total household income-Agricultural production income)
	Household energy use (HEU)	First, according to the questions "How often does your household use firewood/grass/straw (C14), coal (C15), gas (C16), cow dung (C17), biogas (C18), natural gas (C19), LPG (C20), electricity (C21) and solar energy (C22) in your daily life (cooking/heating/bathing)? a = never use = 1, b = hardly ever use = 2, c = occasionally use = 3, d = often use = 4, e = daily use = 5"; Then, the frequency scores for "C14-C17" were summed and set as the frequency of non-clean energy(FNCE) use, and the frequency scores for "C18-C22" were summed and set as the frequency of clean energy(FCE) use; Finally, FNCE and FCE were compared and if FCE < FNCE, assign a value of "0", if FCE = FNCE, assign a value of "1", if FCE > FNCE, assign a value of "2".
	Non-agricultural economics	Does your village develop non-agricultural economic industries? 1 = yes, 0 = no.

Note: B08, B09, B10, B11, B12, B13, B14, B15, B16, B17, B18, B22, B23, B27, B31, C13, C14-C22 refer to the question numbers in the questionnaire. GPA_2 for robustness testing.

Table 2 is the descriptive statistics of the variables used in this paper. Among them, the average value of agricultural green production is 0, and the proportion of farmers who rent in and out land is 26.9% and 36.1% respectively, indicating that the proportion of farmers who participate in land transfer business is relatively small, and land transfer has not really been popularized; The average age of the head of household is about 42 years old, of which 72.2% are male. Most of them are married, and their educational background is concentrated in high school and below. This indicates that the education level of the masses in rural areas needs to be improved, which will also indirectly affect land transfer and green agricultural development. Most of the management decision-makers are in good health. They have three good friends in the local area. There are about two agricultural production workers per household for a long time. The average agricultural subsidy per household is 6.985 after taking the logarithm; the health of family members, social capital endowment and the number of agricultural subsidies available are important reference conditions for farmers to carry out agricultural production and what scale of agricultural production. In the past three years, 65.2% of the heads of households have gone out to work, and the average non-agricultural production income of households is 11.563 after taking the logarithm. Whether they go out to work and how much non-agricultural production income, they have will also affect the land transfer and green production behavior decisions of farmers from the Perspective of funds; The average result of household energy use is 1.729, indicating that most households use clean energy and have a certain awareness and behavior of green production; About 38.1% of the villages develop non-agricultural economy. Only with certain non-agricultural economic development can there be non-agricultural economic income, so that farmers can consider land outflow decisions. All these factors will have an impact on agricultural green production.

Table 2. Results of descriptive statistics for variables.

Variable	Observations	Mean	Std. Dev.	Min	Max
GPA	454	0	0.522	−1.123	0.779
GPA_2	454	2.434	1.054	1	6
LRI	454	0.269	0.444	0	1
LRO	454	0.361	0.481	0	1
Age	454	42.33	8.599	18	68
Gender	454	0.722	0.448	0	1
Marriage	454	2.04	0.513	1	4
Education	454	2.771	1.003	1	6
Health	454	4.02	0.558	1	5
SC	454	2.892	0.802	1	4
AL	454	2.126	0.619	1	5
AS	454	6.985	1.686	0	8.7
EWO	454	0.652	0.477	0	1
NAPI	454	11.563	0.596	9.9	14.22
HEU	454	1.729	0.63	0	2
NAE	454	0.381	0.486	0	1

3.3. Method

In order to better understand the impact of land transfer on green production of farmers and measure the level of green production of farmers, this paper makes a more comprehensive analysis of land transfer, personal characteristics of household heads, family characteristics and social characteristics. Take the green production level (GPA) of farmers as the explained variable, land inflow (LRI) and land outflow (LRO) as the core explanatory variables, and take the age, gender, marital status, education, health, social capital (SC), whether to work outside (EWO), and the family characteristics of the head of the household. The number of long-term agricultural labor in the household (AL), family agricultural subsidies (AS), non-agricultural production income (NAPI), household clean energy use (HEU) and whether the village with social characteristics develops non-agricultural economy (NAE) are taken as control variables to establish a scientific measurement model, so as to realize the analysis of farmers' green production level. First, the OLS model is as follows:

$$\begin{aligned}\text{GPA} = {} & \beta_0 + \beta_1 LRI + \beta_2 LRO + \beta_3 AGE + \beta_4 Gender + \beta_5 Marriage + \beta_6 Education + \\ & \beta_7 Health + \beta_8 SC + \beta_9 AL + \beta_{10} AS + \beta_{11} EWO + \beta_{12} NAPI + \beta_{13} HEU + \beta_{14} NAE + \mu\end{aligned} \tag{1}$$

Among them, GPA is the green production level of farmers, LRI, LRO, Age, Gender, Marriage, Education, Health, SC, AL, AS, EWO, NAPI, HEU, NAE are various factors that affect the green production level of farmers, and $\beta_{n(e.g.\beta_0)}$ is the regression coefficients. If all βn are significant, then LRI and LRO have a significant effect on the GPA. μ is a random perturbation term. After considering the endogenous problem, the 2SLS model in this paper is as follows:

First stage:

$$\begin{aligned} \text{LRI} = {} & \alpha_0 + \alpha_1\text{COVID-19} + \alpha_2 Distance + \alpha_3 AGE + \alpha_4 Gender + \alpha_5 Marriage + \alpha_6 Education + \alpha_7 Health \\ & + \alpha_8 SC + \alpha_9 AL + \alpha_{10} AS + \alpha_{11} EWO + \alpha_{12} NAPI + \alpha_{13} HEU + \alpha_{14} NAE \end{aligned} \quad (2)$$

Second stage:

$$\begin{aligned} \text{GPA} = {} & \lambda_0 + \lambda_1 LRI + \lambda_2 LRO + \lambda_3 AGE + \lambda_4 Gender + \lambda_5 Marriage + \lambda_6 Education + \lambda_7 Health + \lambda_8 SC + \lambda_9 AL \\ & + \lambda_{10} AS + \lambda_{11} EWO + \lambda_{12} NAPI + \lambda_{13} HEU + \lambda_{14} NAE + \mu_1 \end{aligned} \quad (3)$$

"COVID-19" and "Distance" are instrumental variables. Formula (2) represents the first stage regression relationship between the instrumental variable and the explanatory variable, and Formula (3) represents the second stage regression relationship between the instrumental variable and GPA after the significance test. Through two-stage regression, the purpose of using 2SLS to deal with endogenous problems is realized. $\alpha_n(e.g.\alpha_0)$ and λ_n(e.g., λ_0) are the regression coefficients. γ and μ_1 is the residual term.

Regulatory effect first appeared in the field of psychology, and then gradually introduced into management and economic research. Regulatory effect means that the third variable m effectively affects the relationship between X and Y. This paper believes that the three variables of agricultural training (AT), digital literacy (DL) and agricultural related loans (AL) have a regulating effect on the impact of land transfer on Farmers' green production, so the regulation model is set up as follows:

$$\begin{aligned} \text{GPA} = {} & \beta_0 + \beta_1 AT + \beta_2 AGE + \beta_3 Gender + \beta_4 Marriage + \beta_5 Education + \beta_6 Health + \beta_7 SC + \beta_8 AL + \\ & \beta_9 AS + \beta_{10} EWO + \beta_{11} NAPI + \beta_{12} HEU + \beta_{13} NAE + \mu_2 \end{aligned} \quad (4)$$

$$\begin{aligned} \text{GPA} = {} & \beta_0 + \beta_1 LRI + \beta_2 LRO + \beta_3 AGE + \beta_4 Gender + \beta_5 Marriage + \beta_6 Education + \beta_7 Health + \beta_8 SC + \\ & \beta_9 AL + \beta_{10} AS + \beta_{11} EWO + \beta_{12} NAPI + \beta_{13} HEU + \beta_{14} NAE + \mu \end{aligned} \quad (5)$$

$$\begin{aligned} \text{GPA} = {} & \beta_0 + \beta_1 AT * LRI + \beta_2 AGE + \beta_3 Gender + \beta_4 Marriage + \beta_5 Education + \beta_6 Health + \beta_7 SC + \beta_8 AL + \\ & \beta_9 AS + \beta_{10} EWO + \beta_{11} NAPI + \beta_{12} HEU + \beta_{13} NAE + \mu_3 \end{aligned} \quad (6)$$

Formula (4) is the regression relationship between the green production level (GPA) of farmers and the adjustment variable agricultural training (at), and the measurement coefficient is obtained; Formula (5) is the regression relationship between the green production level (GPA) of farmers and land transfer (LRI), and Formula (6) is the regression relationship between the green production level (GPA) of farmers and agricultural training (AT) * land transfer (LRI). βn is the regression coefficients. If all βn are all significant, then AT has a moderating effect on the LRI impact on GPA. μ_n(e.g., μ_2) is a random perturbation term. I f the regression result is significantly higher than the original regression, the adjustment effect should be significant. The adjustment effect of the other two variables is tested in the same way and will not be listed here.

4. Results

4.1. Basic Regression

According to Table 3, through the basic OLS regression, it can be seen that the land inflow is significantly positively correlated with the green production level of farmers at the level of 1%, while the land outflow is significantly negatively correlated at the level of 1%. Because the two are opposite, the regression results are in line with expectations. It shows that the land inflow can promote the green production behavior of farmers, specifically, if the land inflow increases by one unit, the green production index of farmers increases by 22.3%, while if the land outflow increases by one unit, the green production index of farmers decreases by 5.46%. The reasons may be as follows: on the one hand, the inflow of land has expanded the scale of land, resulting in certain scale benefits, and farmers have more funds to buy green production tools or technologies; On the other hand, farmers gain more from large-scale planting, so they have more enthusiasm to learn green production methods and technologies, so as to gain more benefits in the long run. Table 3 also reports the relationship between the control variables and agricultural green production. There is a significant negative correlation between age and agricultural green production, which indicates that older farmers may be more accustomed to traditional agricultural operations and less likely to accept advanced production technology [48]. Marriage and gender have a significant negative impact on agricultural green production, indicating that bad marriage will reduce the green production level of farmers. At the same time, female heads of households may be more likely to transfer out of land than male heads of households, which will further affect agricultural green production [49]. The education level and health level are negatively correlated with the level of green agriculture. The reason may be that people with higher education level are more inclined to work in cities, and healthier farmers may choose to work in cities to improve their short-term income. Both social capital and the number of long-term family labor significantly promote agricultural green production, indicating that farmers with good social and human relations and sufficient family labor have more resources and capabilities to carry out green production [50]. The negative impact of agricultural subsidies on agricultural green production may be due to the increase in funds and the indirect increase in the use of chemical fertilizers, pesticides, and plastic films due to the limitation of farmers' green production consciousness [51]. Both migrant workers and non-agricultural income have significantly promoted agricultural green production, probably because non-agricultural employment has become a common phenomenon in China, and migrant workers can contact more advanced technologies and obtain more funds [46]. At the same time, the use of household clean energy is significantly positively correlated with agricultural green production, indicating that the use of household clean energy will affect the green environmental protection consciousness of farmers, and thus affect all aspects of life [52].

Table 3. Regression results of the impact of land transfer on GPA.

	(1)	**(1)**	**(1)**	**(1)**
Variables	GPA	GPA	GPA	GPA
LRI	0.166 ***	0.223 ***		
	(0.0530)	(0.0566)		
LRO			−0.0766	−0.0546
			(0.0493)	(0.0537)
Age		−0.0162 ***		−0.0139 ***
		(0.00415)		(0.00419)
Gender		−0.0876 *		−0.0940 *
		(0.0525)		(0.0532)
Marriage		−0.0843 *		−0.0674
		(0.0503)		(0.0501)
Education		−0.0577 *		−0.0425
		(0.0304)		(0.0305)
Health		−0.00182		−0.0159
		(0.0380)		(0.0377)
SC		0.0651 **		0.0683 **
		(0.0296)		(0.0305)

Table 3. *Cont.*

	(1)	(1)	(1)	(1)
AL		0.0778 **		0.0526
		(0.0349)		(0.0351)
AS		−0.0193 *		−0.0170
		(0.0107)		(0.0114)
EWO		0.0974 *		0.119 **
		(0.0524)		(0.0532)
NAPI		0.0998 ***		0.124 ***
		(0.0383)		(0.0407)
HEU		0.0936 ***		0.0947 ***
		(0.0341)		(0.0354)
NAE		−0.0522		−0.0659
		(0.0487)		(0.0493)
Constant	−0.0447	−0.549	0.0277	−0.850 *
	(0.0289)	(0.478)	(0.0318)	(0.496)
Observations	454	454	454	454
R-squared	0.20	0.153	0.11	0.125

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.GPA = Green production in agriculture; LRI = Land rent in, LRO = Land rent out; SC = Social capital; AL = Number of agricultural labors; AS = Agricultural subsidy; EWO = Experiences of work outside; NAPI = Non-agricultural production income; HEU = Household energy use; NAE = Non-agricultural economics.

4.2. Endogenous Issue Treat

As there may be endogenous problems caused by mutual causality and missing variables, this paper adopts the 2SLS model to deal with them and the results are reported in Table 4. Considering the availability of data and the relevant selection requirements of instrumental variables, two variables, "the impact of COVID-19" and "the actual distance between the head of household and the county seat" are selected as the instrumental variables of this article. The reasons are: first, the COVID-19 epidemic may affect the work of farmers, leading to the expansion or reduction in their agricultural production scale, thus affecting the inflow or outflow of land. However, COVID-19 has no direct relationship with whether farmers produce green; Similarly, the distance between the head of household and the county will affect whether the farmers are willing to stay in the countryside for agricultural production or live and work in the city. If agricultural production is carried out in the countryside, there may be land inflow, otherwise there may be land outflow. At the same time, this distance has no direct relationship with whether the farmers are engaged in green production. Therefore, both instrumental variables meet the exogenous requirements that are related to the explanatory variable but not directly related to the explained variable. The Hausman test values of the two instrumental variables are less than 0.005, which indicates that the choice of the instrumental variables is reasonable. Observing the regression results of the 2SLS model, the impact values of the two instrumental variables on the green production level of farmers are 19.5% and 18.7%, respectively, which are less than 22.3% in the basic regression. This indicates that the basic regression slightly overestimates the promotion effect of land inflow on the green production level of farmers.

Table 4. Results of endogeneity treatment for LRI and GPA regressions:2SLS model.

	IV = COVID_19			**IV = Distance**		
	First Stage		**Second Stage**	**First Stage**		**Second Stage**
	Probit (1)	OLS (2)	2SLS (3)	Probit (4)	OLS (5)	2SLS (6)
Variables	LRI	GPA	GPA	LRI	GPA	GPA
LRI		0.223 ***	0.195 ***		0.223 ***	0.187 ***
		(0.0566)	(0.0517)		(0.0566)	(0.0624)
COVID_19	0.377 ***	0.0251				
	(0.133)	(0.0199)				
Distance				−0.353 ***	0.256	
				(0.0689)	(0.137)	
CV	Control	Control	Control	Control	Control	Control
Constant	−0.744 ***	0.055 **	0.0547 **	0.570 **	0.451	0.0714 *
	(0.0787)	(0.0241)	(0.0229)	(0.237)	(0.255)	(0.0321)
F-value	69.21			102.33		
R-squared		0.184			0.210	
Observations	454	454	454	454	454	454

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. GPA = Green production in agriculture; LRI = Land rent in; COVID_19 = Has your agricultural production been affected by COVID-19? Distance = How many kilometers is the actual distance from your home to the county?; CV = Control Variables.

4.3. Robustness Test

In this paper, variable replacement method is used to test the robustness. Here, the core explained variable is replaced, and GPA is replaced by GPA_2. The results are shown in Table 5. It can be seen from the table that after the robustness test, the land inflow still significantly improved the green production level of farmers, indicating that the empirical results of this paper are reliable.

Table 5. Robustness test results of the regression of LRI and GPA.

	OLS (1)	**OLS (2)**	**OLS (3)**	**OLS (4)**
Variables	GPA_2	GPA_2	GPA_2	GPA_2
LRI	0.236 **	0.277 ***		
	(0.119)	(0.104)		
LRO			−0.469	−0.349
			(0.292)	(0.267)
CV		Control		Control
Constant	2.370 ***	8.403 ***	0.603	0.953
	(0.0553)	(1.231)	(0. 466)	(0.621)
Observations	454	454	454	454
R-squared	0.212	0.161	0.119	0.170

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$. GPA_2 = Green production in agriculture; LRI = Land rent in, LRO = Land rent out; CV = Control Variables.

4.4. Heterogeneity Test

In this paper, the heterogeneity test is conducted according to whether they have environmental protection awareness, whether they are rural elites, whether they buy agricultural insurance, and whether they suffer from agricultural disasters. The reason is that whether they have environmental protection awareness and whether they are rural elites as a whole will reflect different personal qualities, so they have different perceptions of land transfer. People with strong education and administrative ability may be more inclined to land inflow, then it will have a heterogeneous impact on agricultural green production; Farmers who have purchased agricultural insurance at the same time or have not suffered from agricultural disasters may have more confidence in planting, so they will choose to expand the planting scale and carry out land inflow, which will have a heterogeneous impact on their green production level.

4.4.1. Heterogeneity Analysis for AEP and RE

We used the data from the question "How does your household dispose of the waste generated in your life? (a = dumping, b = burning, c = burying, d = disposal by a professional organization)" to measure awareness of environmental protection (AEP) and then perform a heterogeneity analysis. At the same time, we used the data from the question "Are you an official leader in your village? (a = yes, b = no)" to measure rural elite (RE) and then perform a heterogeneity analysis. According to the results in Table 6, the inflow of land has significantly improved the agricultural green production level of those who are environmentally conscious and rural elites [46].

Table 6. Results of heterogeneity analysis of the effect of LRI on GPA: AEP and RE.

	OLS (1)	**OLS (2)**	**OLS (3)**	**OLS (4)**
Variables	AEP = 1	AEP = 0	RE = 1	RE = 0
	GPA	GPA	GPA	GPA
LRI	0.196 ***	−0.0243	0.305 **	0.136 **
	(0.0572)	(0.119)	(0.123)	(0.0587)
CV	Control	Control	Control	Control
Constant	0.00300	−0.128 **	−0.0866	−0.0331
	(0.0350)	(0.0499)	(0.0630)	(0.0325)
R-squared	0.134	0.091	0.156	0.140
Observations	306	148	92	362

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$. GPA = Green production in agriculture; LRI = Land rent in; AEP = Awareness of environmental protection; RE = Rural elite; LRI = Land rent in; CV = Control Variables.

Awareness of environmental protection (AEP) in this paper refers to the consciousness of adopting green technology in various family life behaviors or agricultural production behaviors in ordinary life, so as to form a consciousness of protecting the environment. Those who are environmentally conscious have better quality and broader vision. They know that green production not only has higher benefits for crops or soil in the long run, but also in this era, green crops are also more popular. Rural elite (RE) in this paper refer to those farmers who have been or are becoming village cadres in the development of the village. To become rural elites, that is, village cadres, these farmers, they have more opportunities to contact with some publicity or training on green agricultural production. At the same time, they must also play a leading role for other villagers to a certain extent, and better carry out green production, so that the level of green production is higher.

4.4.2. Heterogeneity Analysis for AI and AD

We used the data from the question "Does your household buy agricultural insurance in the last 3 years? (a = 1 = Yes; b = 0 = No)" to measure agricultural insurance (AI) and then perform a heterogeneity analysis. And at the same time, we used the data from question "Has your household agricultural production been affected by natural disasters/pests and diseases in the last 3 years? (a = 1 = Yes; b = 0 = No)" to measure agricultural disease (AD) and then perform a heterogeneity analysis. According to the results in Table 7, the inflow of land has significantly improved the agricultural green production level of these farmers who have purchased agricultural insurance and have not been affected by agricultural disasters [53].

Table 7. Results of heterogeneity analysis of the effect of LRI on GPA: AI and AD.

	OLS (1)	**OLS (2)**	**OLS (3)**	**OLS (4)**
Variables	AI = 1	AI = 0	AD = 1	AD = 0
	GPA	GPA	GPA	GPA
LRI	0.350 ***	0.136 **	−0.109	0.200 ***
	(0.0671)	(0.0656)	(0.158)	(0.0568)
CV	Control	Control	Control	Control
Constant	−0.0268	−0.0582	0.0545	−0.0679 **
	(0.0416)	(0.0399)	(0.0553)	(0.0331)
R-squared	0.160	0.141	0.132	0.192
Observations	165	289	70	384

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$. GPA = Green production in agriculture; LRI = Land rent in; AI = Agricultural insurance; AD = Agricultural disease; LRI = Land rent in; CV = Control Variables.

Agricultural insurance (AI) in this paper refers to whether your family has purchased agricultural production insurance in the past three years. Farmers who have purchased agricultural insurance are more confident to some extent. Even if they do not plant well, they will bear fewer losses. Therefore, they are more confident in expanding the planting scale of land inflow and apply green production technology. Agricultural disease (AD) in this paper refers to whether your family's agricultural production has been affected by natural disasters/pests and diseases in the agricultural production activities in the past three years. Because the agricultural industry is greatly affected by natural factors, although current science and technology have reduced this limit, it is still a relatively high-risk industry. If farmers have suffered agricultural disasters and suffered relatively large losses, they may lack confidence in agricultural planting and resist the inflow of land. Therefore, farmers who have not suffered natural disasters are more likely to have land inflow, this will reflect the heterogeneity of the green production level of farmers.

5. Further Research: Moderating Effect Test

5.1. Testing for Agricultural Training Moderation Effects

We used the data from the question "Do you participate in agricultural training activities? (a = 1 = Yes; b = 0 = No)" to measure agricultural training (AT) and then examine whether AT plays a moderating role in the effect of LRI on GPA. The results of model (2) in Table 8 show that agricultural training has a significant contribution to agricultural green production. Model (3) reveals the interaction term among AT, LRI and GPA, and the interaction term between agricultural training and land rent in (LRI $\times$ AT) is significantly positive (coef = 0.197, $p < 0.01$), indicating that AT plays a regulatory role in the relationship between LRI and GPA and enhances the positive effect of LRI on GPA.

Agricultural training in this paper refers to the training on agricultural planting methods and technologies in the past agricultural production experience, so as to carry out agricultural production more efficiently and green. With the large increase in agricultural training, it is easier for farmers to master advanced production technologies and expand their own business scale, and the decision-making of land inflow will become more and more easy to choose, which will drive the level of agricultural green production [46], that is, agricultural training has a positive regulatory effect on the relationship between land inflow and agricultural green production.

Table 8. Mechanistic analysis of the effect of LRI on GPA: moderating effect test of AT, DL and AL.

	OLS (1)	**OLS (2)**	**OLS (3)**	**OLS (4)**	**OLS (5)**	**OLS (6)**	**OLS (7)**
	GPA	GPA	GPA	GPA	GPA	GPA	GPA
LRI	0.223 ***	0.155 ***	0.149 ***	0.207 ***	0.194 ***	0.201 ***	0.518 **
	(0.0566)	(0.0536)	(0.0521)	(0.0521)	(0.0734)	(0.0541)	(0.249)
AT		0.111 **	0.248 ***				
		(0.0562)	(0.0652)				
LRI × AT			0.197 ***				
			(0.0594)				
DL				0.205 ***	0.196 ***		
				(0.0478)	(0.0576)		
LRI × DL					0.301 ***		
					(0.0640)		
AL						0.0843 **	0.0483 **
						(0.0383)	(0.0208)
LRI × AL							0.114 ***
							(0.0265)
CV	Control	Control	Control	Control	Control	Control	Control
Constant		0.109 **	−0.0394	−0.0844 **	−0.0278	−0.0900	−0.0561 *
		(0.0468)	(0.0273)	(0.0357)	(0.0259)	(0.0832)	(0.0287)
R-squared	0.153	0.109	0.216	0.197	0.129	0.209	0.199
Observations	454	454	454	454	454	454	454

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. GPA = Green production in agriculture; LRI = Land rent in; AT = Agricultural training, "Do you participate in agricultural training activities? a = 1 = Yes; b = 0 = No"; DL = Digital literacy, "Are you able to participate in online shopping through your smartphone or computer? a = yes, b = no", if "a" is selected, the respondent is considered to have DL, set "DL = 1", and if "b" is selected, set "DL = 0"; AL = Agricultural loan, "Has your household applied for and received a loan from a bank for agricultural production in the last 3 years? a = 1 = Yes; b = 0 = No"; CV = Control Variables.

5.2. Testing for Digital Literacy Moderation Effects

We used the data from the question "Are you able to participate in online shopping through your smartphone or computer? (a = yes, b = no)" to measure digital literacy (DL) and then examine whether DL plays a moderating role in the effect of LRI on GPA. The results of model (4) in Table 8 show that digital literacy has a significant contribution to agricultural green production. Model (5) reveals the interaction term among DL, LRI and GPA, and the interaction term between digital literacy and land rent in (LRI × DL) is significantly positive (coef = 0.301, $p < 0.01$), indicating that DL plays a regulatory role in the relationship between LRI and GPA and enhances the positive impact of LRI on GPA.

Digital literacy in this paper refers to the ability of farmers to use digital equipment to obtain information and to use technology and information for their own interests. With the development of science and technology and the progress of society, the digital literacy of farmers is also constantly improving, which will also improve their awareness of land transfer and agricultural green production and make it easier to obtain advanced green production technology, so as to more encourage them to carry out agricultural green production [54]. That is, digital literacy has a positive regulatory effect on the relationship between land inflow and agricultural green production level.

5.3. Testing for Agricultural Loans Moderation Effects

We used the data from the question "Has your household applied for and received a loan from a bank for agricultural production in the last 3 years? (a = 1 = Yes; b = 0 = No)" to measure agricultural loan (AL) and then examine whether AL plays a moderating role in the effect of LRI on GPA. The results of model (6) in Table 8 show that agricultural loans have a significant contribution to agricultural green production. Model (7) reveals the interaction term among AL, LRI and GPA, and the interaction term between agricultural training and land rent in (LRI × AL) is significantly positive (coef = 0.114, $p < 0.01$), indicating that AL plays a regulatory role in the relationship between LRI and GPA and enhances the positive impact of LRI on GPA.

Agricultural loans in this paper refer to whether your family has applied for and received agricultural production loans from the bank in the past three years. With the help and support of the state and the government for rural areas and the development of Inclusive Finance, farmers have more opportunities to obtain agricultural related loans, so that they have more financial support for both the payment of land inflow fees and the purchase of technologies and equipment for agricultural green production, thus promoting agricultural green production to a certain extent [55]. That is, agricultural loans have a positive regulatory effect on the relationship between land inflow and agricultural green production level.

6. Conclusions, Discussion and Policy Recommendation

6.1. Conclusions

In the context of tighter resource and environmental constraints, how to take the path of agricultural modernization with high output efficiency, product safety, resource conservation and environmental friendliness is a realistic problem that developing countries urgently need to solve in the new era, and land transfer is an important way to connect traditional agriculture with new agriculture. First of all, this paper makes a theoretical analysis of the impact of land transfer on agricultural green production by using the property rights theory and sustainable development theory. Then, take the data of "investigation on household energy consumption and green agriculture development" in Sichuan Province in 2022 as a sample, and select "whether the household agricultural industry is affected by the impact of COVID-19?", "the actual distance between your home and the county seat is taken" as the instrumental variable, and OLS, 2SLS and regulatory effect models are used for empirical testing. The results show that: (1) land inflow significantly improves the level of agricultural green production, with a unit impact of 22.3%, whereas land outflow will inhibit agricultural green production, with a unit impact of 5.46%; After the robustness test and endogenous treatment, the conclusion is still valid; (2) Further research found that the family's long-term agricultural labor, social capital, migrant experience, non-agricultural income and household clean energy use are all positively promoting agricultural green production; Age, education level, health level and agricultural subsidies all inhibit agricultural green production; (3) The heterogeneity analysis found that the inflow of land would significantly promote the level of green agricultural production of farmers who have environmental awareness, have been village cadres, have purchased agricultural insurance and have not suffered from agricultural disasters; (4) Agricultural training, farmers' digital literacy and agricultural related loans have a positive and strengthened regulatory role in the impact of land transfer on agricultural green production.

6.2. Discussion

Agricultural green development (GPA) is a hot topic of global concern. The positive effects of land transfer (LRI, LRO) on green development of agriculture (GPA) are discussed in the current literature. These findings provide a valuable reference for this paper. Based on the empirical analysis of the micro-data of Sichuan Province in China, this paper finds that land inflow (LRI) significantly increases the level of green agricultural production (GPA), which supports the views and conclusions of Sun et al. [3], Hui and Yu [22]. The contributions of this paper include: (1) using micro data sets from China, we explore the impact of land transfer on green agricultural production, and the results verify the reliability of some existing literature conclusions, (2) this paper not only analyzes the impact of land transfer on agricultural green production but also discusses the heterogeneity of farmers, furthermore, the moderating effect of agricultural training, digital literacy and agricultural loan on the impact of land transfer on green agricultural production is analyzed, which makes the research results more comprehensive and clear, and less in the existing literature However, this paper also has some limitations: (1) using the data of Sichuan Province in China, the conclusions may be more applicable to China (region). In the new study, therefore, data from other developing and developed countries should be collected for a comprehensive and comparative analysis leading to conclusions of greater global value; (2) the data are obtained by means of questionnaires, the data provided by many farmers may have errors due to their educational level or other psychological reasons, which will affect the quality of the data to a certain extent, follow-up research can be done by expanding the sample size or optimizing research methods.

6.3. Policy Recommendation

First, the "government's actions" "First of all, the government should further improve the land property rights policy and relevant transfer mechanisms and regulations to make the land transfer more convenient and secure; at the same time, the government should give full play to the role of finance, improve the rural infrastructure construction and financial service construction, ensure the availability of online Village to village access and agricultural related loans, improve the digital capacity and capital turnover capacity of farmers; strengthen the top-level design of agricultural green production, and rely on the village government and Village committees integrate into the grass-roots level, regularly carry out agricultural training, and strengthen the popularization of agricultural green production knowledge and technology of farmers. The second is "market guarantee". We should establish and improve a reasonable, efficient and institutional land transfer market, improve the enthusiasm of farmers for land transfer under the guidance of the government, and actively optimize the equipment and technology market for agricultural green production, so as to ensure that farmers with green production consciousness can make steady progress on this road. The third is "farmer learning". Farmers should follow the tide of scientific and technological development, actively learn digital technology and green agricultural production technology, improve their financial literacy, and gradually integrate into and lead the development of green agriculture, so as to make continuous efforts for their happy life.

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