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**China, Greenhouse Vegetables Planting**

**Study On Greenhouse Vegetables Planting Patterns**  
**-- Investigation and Analysis Through Perspective of Individuals**

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**June 2022**

**【 Abstract 】** Compared with the traditional vegetable planting, the greenhouse vegetable planting pattern has incomparable superiority. Taking Gaoyi County, Hebei Province as an example, this research analyzes the current situation and existing problems in the development of vegetable planting mode in greenhouses from the perspective of farmers through a questionnaire. It has been found that it is necessary to make multiple efforts to improve the quality of workers, promote land transfer from an institutional level, and give policy support to explore a new mode of co-governance between village and enterprise, so as to improve this cutting-edge technology to better meet the market demand.

**【 Key words 】** greenhouse vegetables, vegetable planting, Gaoyi County

With the rapid development of China's economy, people's demand for seasonal fresh vegetables has increased significantly. Greenhouse technology changes the traditional planting method, gets rid of the seasonality, ensures the quantity and quality of vegetables throughout the year, and greatly meets the market demand. It occupies a large proportion in the Chinese vegetable consumption market, especially in the off-season vegetable market, and becomes one of the leading industries in the future agricultural development. As a country with a large population, China is also the country with the largest greenhouse vegetable planting area. It is of practical significance for the domestic vegetable market to discuss the greenhouse vegetable planting mode to improve the vegetable planting yield and quality. Compared with traditional cultivation, greenhouse technology for labor quality put forward higher requirements. Taking the vegetable planting model in Gaoyi County, Hebei Province as an example, this research analyzes the current situation of the greenhouse vegetable planting through the investigation and analysis of farmers, putting forward targeted measures, hoping to provide references for improving the quality of vegetable output and ensuring the supply of vegetables.

## **1. Overview of greenhouse vegetable research**

Greenhouses usually refer to the use of a film-coated frame structure with good thermal insulation performance to provide heat to plants through plastic films in seasons that are not suitable for plant growth.

### **(1) Analysis of vegetable planting advantages in greenhouses**

Compared with the traditional planting method, the greenhouse technology can stagger the normal growth time of crops, break the time and geographical difference, and realize the effect of early spring vegetables coming on the market in advance, late autumn vegetables

coming later, and winter vegetables coming in reverse season. Simultaneously, due to the more reasonable control of water, temperature and humidity, the greenhouse technology can achieve early maturity and high production, increasing the yield by 30%-40%. It without doubt ensures the uninterrupted supply of fresh vegetables throughout the year. As a relatively independent ecological space for plants, greenhouses can greatly reduce the threat of pests and diseases, the interference from external rain and snow disasters and exhaust gas pollution from passing vehicles, improving the quality of vegetables. This cutting-edge technology helps meet people's pursuit of green organic vegetables. Greenhouse technology also promotes the realization of intelligence. As science and technology such as the Internet are increasingly widely used in greenhouse production and planting, greenhouse is more and more "intelligent". They can automatically adjust the temperature, humidity and other conditions according to demand, and production efficiency is significantly improved.

The huge population and shortage of resources determines that China's agricultural technology must lay emphasis on resource-saving technology and improving land productivity technology. The strong market demand determines that China's agriculture must pay attention to technology which is of high-quality, high-yield, high-efficiency and can improve the commercialization and market competitiveness of agricultural products. (Wu, 2000) The greenhouse technology greatly meets the demand, making it popular among China.

## (2) Development of greenhouse technology abroad

Plastic film greenhouse is mainly distributed in Asia, and also have a certain distribution in Europe and the United States. For example, Almeria, known as the "European vegetable capital", is home to one of the most advanced farming techniques in the world. It now covers more than 26,000 hectares of plastic greenhouses, responsible for nearly half of Europe's greenhouse production.

## (3) Domestic research on greenhouse vegetable planting

The research and investigation on greenhouse vegetables in the past mainly focused on planting technology, pest control, soil properties and other aspects. Most of the investigations have carried out in-depth analysis of the present situation of greenhouse vegetables and put forward suggestions.

However, most of the surveys are narrated from the macro level, but ignore the fact that large-scale greenhouse vegetable production as a group behavior, the subjective initiative of each

individual involved is of great significance. Therefore, in the form of questionnaire, this research went deep into the greenhouse farmers in Shaoyjiaying village of Daying Town in Gaoyi County and its surrounding villages, collecting their most direct appeal and their inner thoughts on greenhouse planting, in order to provide reference suggestions for the development of greenhouse vegetables from the micro perspective.

## **2.Introduction to the current situation of greenhouse vegetables in Gaoyi County**

Gaoyi County, located at the southernmost tip of Shijiazhuang city, has a population of 183,000, including an agricultural population of 146,000. The vegetable industry is a characteristic agricultural industry in Gaoyi County. It started in the 1980s and has become the dominant industry with the largest independent input by farmers, outstanding economic benefits and a fast growth rate. By the end of 2020, the planting area of vegetables in the county is 80,800 mu, including 31,000 mu of facility vegetables. The main varieties are tomatoes and cucumbers, with an output of 407,200 tons. The vegetable output value is 780 million yuan. Gaoyi county vegetable industry covers a wide area, absorbing a large number of laborers. The number of people engaged in vegetable production and operation in the county exceeds 60,000, accounting for 46% of the total rural labor force. Therefore, Gaoyi is a typical case.

## **3.Investigation and analysis of vegetable planting patterns**

On the basis of relevant domestic questionnaires, this one sets questions for greenhouse farmers, and carries out an investigation on the planting situation of vegetables in rural greenhouses. The questionnaire is composed of three parts, namely, the questionnaire title, the questionnaire description and the survey title, with a total of 18 questions.

The object of this investigation is the farmers engaged in greenhouse vegetables in Daying town, Gaoyi County, Hebei Province, mainly in Shaojiaying village, including several surrounding villages. The questionnaire was mainly conducted in the form of a combination of electronic and paper questionnaires in May 2022. At last, 62 electronic questionnaires and 14 paper ones were received, with a total of 76 valid answers. The following are the results of the survey.

### **(1) Personal information of growers**

The age distribution of farmers engaged in greenhouse vegetable planting mainly

concentrated in 30-60 years old. 30-45 years old accounted for 43.42%. 46-60 years old accounted for 44.74%. But young people under 30 only accounted for 9.21%. The education level of farmers is generally low. Only 7.89% of farmers have received college or undergraduate education, 26.32% have high school or technical secondary school education, and the remaining 65.79% have junior high school education or even below (Figure 1). It can be seen that very few young people engaged in greenhouse vegetable industry and the farmers have a low level of education.

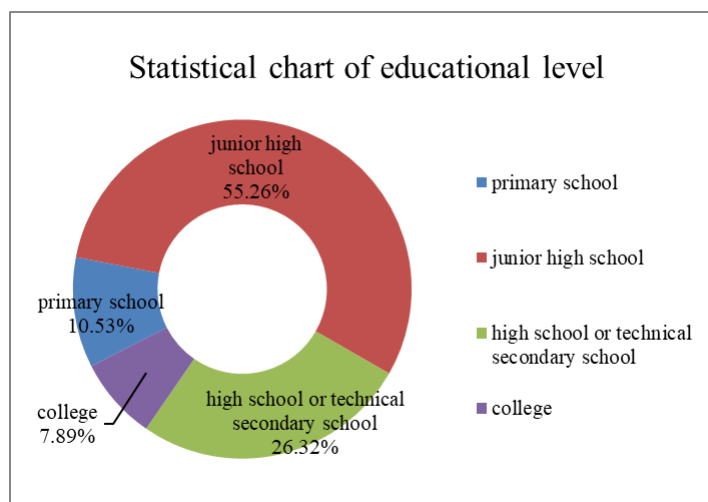


Figure1 Statistical chart of education level of vegetable farmers in greenhouses

(2) Scale of individual greenhouses, annual income and working hours

Among the surveyed farmers, 52.63% owned small sheds of 1 to 2 mu, 38.16% medium-sized sheds of 3 to 4 mu, and 9.21% large sheds of 5 to 7 mu (Figure 2). Greenhouses vegetables were mainly planted by families in local areas, so small and medium-sized greenhouses were the main ones. 47.37% of the growers have an annual income of 40,000 to 60,000 yuan , and 17.11% of them have an annual income of more than 60,000 yuan , which is higher than the local average income . Among the surveyed farmers, nearly 20% have been engaged in greenhouse planting for more than 10 years, and 14.47% have been engaged for 7-9 years (Figure 3). Nearly 70% of farmers are optimistic about the prospect of greenhouse vegetables, and only 7.89% are not. In terms of whether to expand the planting scale, 52.63% said yes, indicating that greenhouse vegetable planting is an advantageous industry that local farmers are willing to invest.

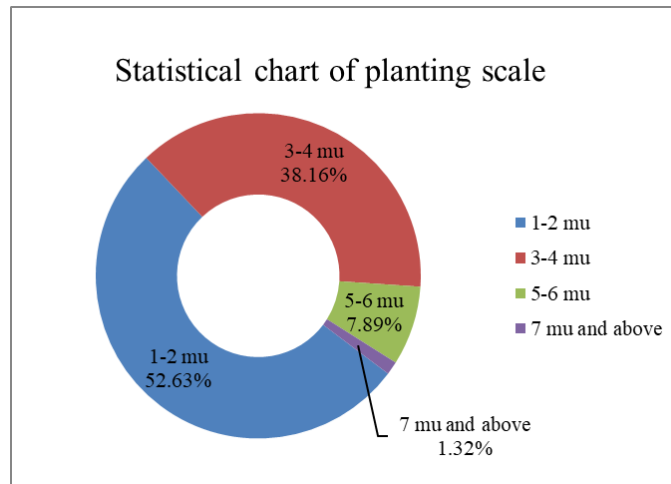


Figure 2 Statistical chart of greenhouse vegetable growers' planting scale

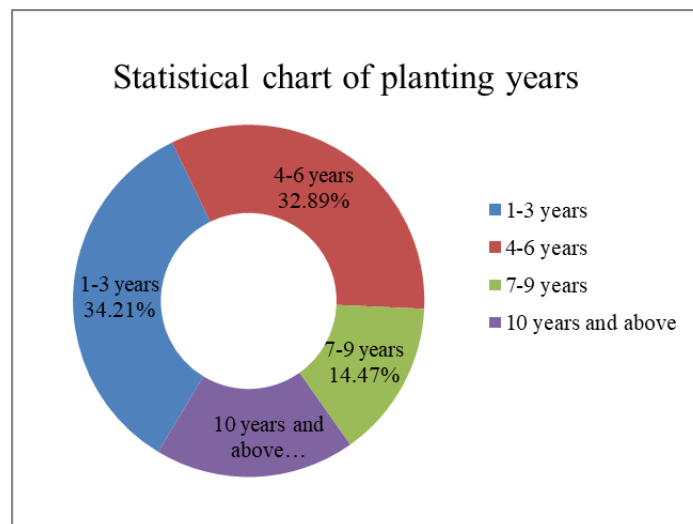


Figure 3 Statistical chart of greenhouse vegetable growers' planting years

### (3) The popularity and effect of government subsidies from the perspective of farmers

This survey analyzed government subsidies from three aspects: technical training, agricultural technician guidance and subsidies. The farmers who have received relevant technical training account for 56.58%, and 65.79% have received guidance from agricultural technicians. 44.74% received government subsidies for greenhouse vegetable planting (Figure 4). It can be seen that government funding is quite effective but the popularity needs to be further improved.

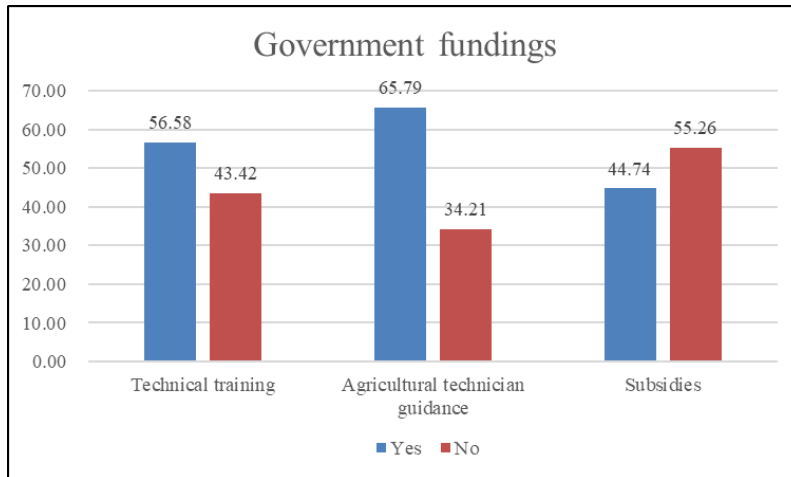


Figure 4 Statistical chart of government fundings for greenhouse vegetable growers

(4) Investigation of individuals' choices of vegetable planting varieties, planting methods and sales methods

Local growers mainly choose vegetable varieties according to market demand and experience inheritance, accounting for 43.42% and 38.16% respectively, and 30.26% choose to follow the public (see Figure 5). The frequency of planting mode selection decreased successively to continuous cropping (51.32%), crop rotation (40.79%), intercropping (19.74%) and interplanting (3.95%), as shown in Figure 6.

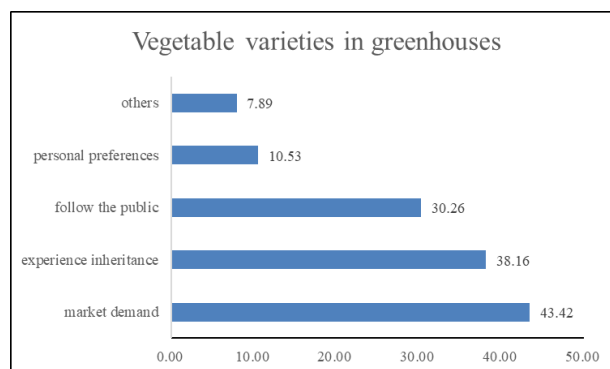


FIG. 5 Statistical chart of vegetable varieties in greenhouses

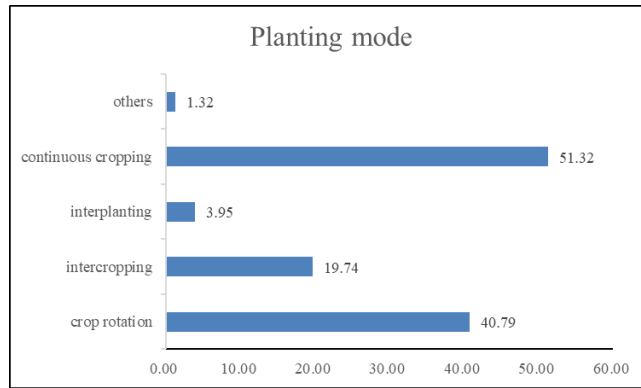


FIG. 6 Statistical chart of vegetable planting mode in greenhouses

(5) Investigation on pesticide use and water saving in farmers' production process

67.11% of growers indicated that pesticides were occasionally used, 18.42% used pesticides frequently, and 14.47% never used pesticides. The use of pesticides is based on the guidance from experts or agricultural technicians (61.84%), seeking advice from others (30.26%), and ancestors' experience (18.42%). 69.74% of the farmers use drip irrigation (34.21%), sprinkler irrigation (10.53%), surge irrigation (25.00%) and other ways to save water, while 42.11% of the farmers did not take special water-saving measures (see Figure 9).

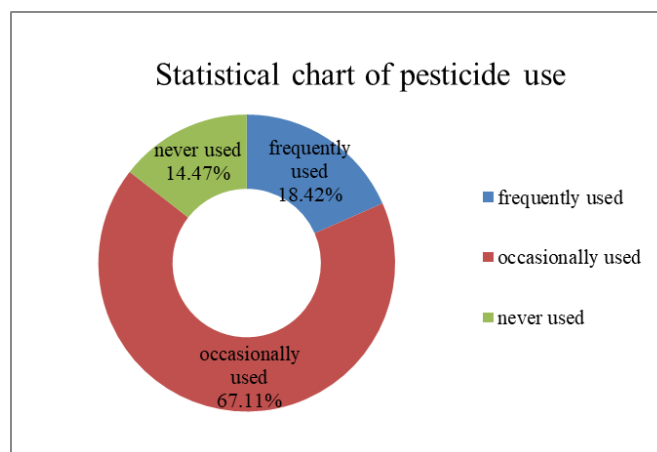


FIG. 7 Statistical chart of pesticide use in vegetables in greenhouses



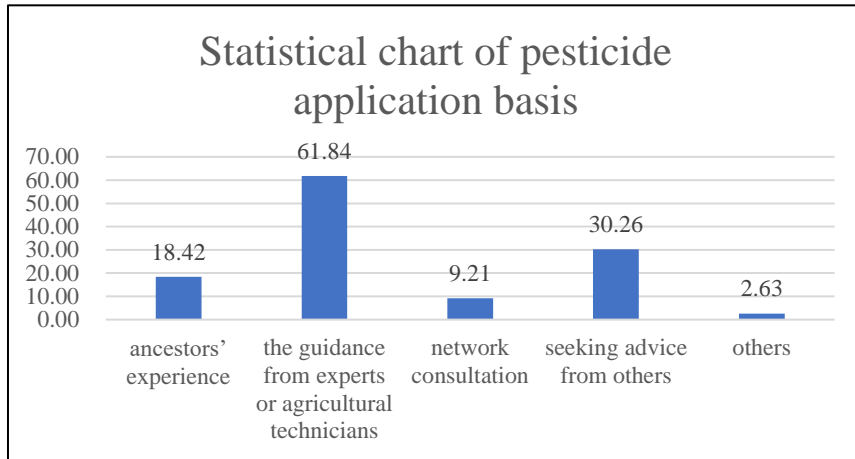


FIG. 8 Statistical chart of pesticide application basis for vegetables in greenhouses

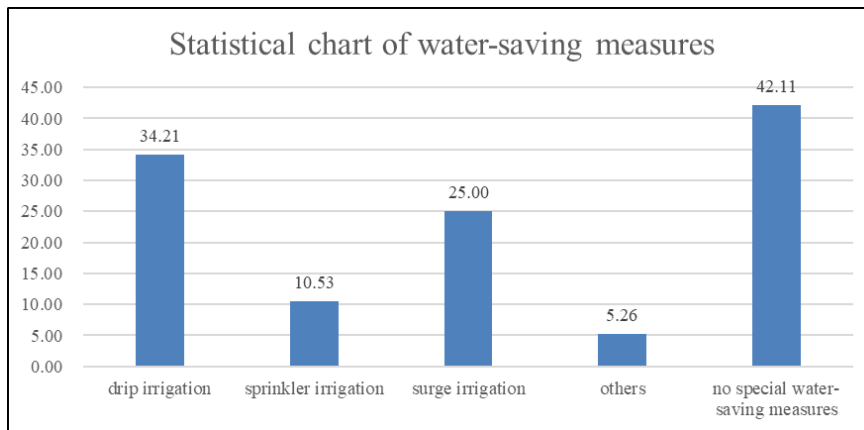


Figure 9 Statistical chart of water-saving measures for vegetables in greenhouses

Through the questionnaire, we found that greenhouse vegetable cultivation status can be classified as the following:

- i. There are few young laborers in greenhouse vegetable cultivation, and the peasants' cultural level is relatively low.
- ii. Farmers' enthusiasm for greenhouse planting is high. Greenhouse vegetables are mainly family planting by small individual households.

iii. A large number of farmers can receive government subsidies and preferential treatment, but the popularity needs to be further improved.

iv. Farmers still have some unscientific methods in the process of planting.

#### **4. Feasibility Measures of Vegetable Greenhouse Development**

Based on the above investigation and analysis, this paper puts forward the following measures for the existing situation, hoping to provide some guidance for the follow-up development of greenhouse vegetables and better help the development of greenhouse vegetables.

##### **(1) Further Improvement of Scientific Literacy of Workers**

As the fundamental factor of vegetable planting quality in greenhouse, farmers' literacy plays a decisive role in the production of vegetables.

According to the survey results, more than half of the growers only receive junior high school education, and their educational level is relatively low. That may trigger problems in mastering new technology and cause old-fashioned thinking, which hinder the further application of science and technology in greenhouse vegetable planting.<sup>[2]</sup> (Liu, 2015) The government's active provision of guidance to relevant agricultural technicians has greatly addressed this issue. Most farmers have access to agricultural technicians' guidance in choosing spraying pesticides, thus avoiding copying past experience and ensuring the quantity and quality of vegetables.

However, in terms of water-saving measures, nearly half of the respondents said they had 'no special water-saving measures' and did not pay attention to rotation, intercropping, intercropping and other planting methods and chose more continuous cropping that seemed to benefit. It can be seen that the guidance of agricultural technicians still has certain limitations. Most farmers are driven by direct profit, blindly pursuing to improve the quality and income of crops. But the continuous cultivation finally results in reducing soil fertility, increasing the possibility of pests and diseases<sup>[3]</sup> (Lu, 2018), ignoring the principle of sustainable development.

Therefore, I put forward the following suggestions.

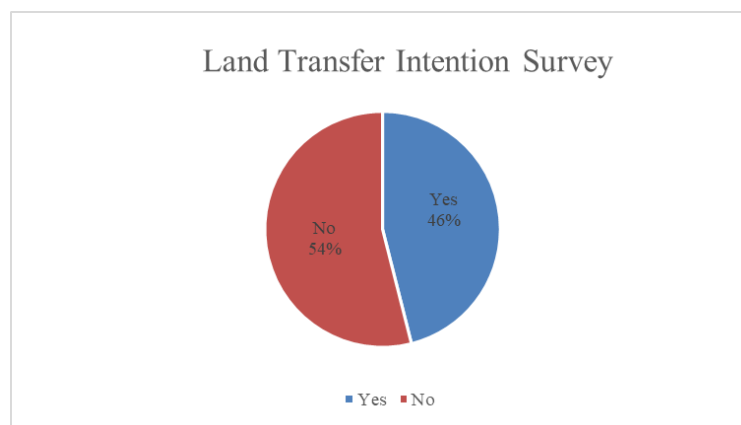
i. We should integrate relevant learning resources, strengthen cooperation with universities such as the Provincial Academy of Agricultural Sciences and Hebei Agricultural University, strengthen the cultivation of compound talents, cultivate a group of key talents for vegetable planting, carry out regular training for farmers, and strengthen the publicity of new technologies.

ii. Relevant departments should carry out popular education on vegetable planting safety knowledge through multimedia (such as public accounts and video clips), so as to prompt farmers to change their concepts and increase their emphasis on sustainable development, so as to protect environment and improve the quality of vegetables.

iii. All villages and cooperatives should strengthen relevant supervision. The head of the village can be supervisors to remind and urge farmers to grow reasonably.

## (2) Promoting farmers' land transfer and large-scale planting

According to the questionnaire, the scale of greenhouse planting is mainly concentrated in 1-2 mu of small-scale planting, and most of them are contracted by families and individuals, failing to form a centralized large-scale planting. This phenomenon is not conducive to the automation and mechanization of greenhouse vegetable planting. Meanwhile, it can be seen that after the harvest of vegetables, farmers mostly choose to sell them to vendors by themselves, which fails to form an industrial chain and is not conducive to the stability of income. The vast majority of vegetable farmers have the willingness to transfer land (see Figure. 10). It is recommended to guide them to actively promote the structural upgrading of greenhouse vegetables and form large-scale and industrialized planting through land transfer and land contracting. This will undoubtedly improve the utilization efficiency of land resources, liberate the labor force, increase farmers' property income, promote mechanized production and increase products' market competitiveness.



## FIG 10 Land Transfer Intention Survey

### (3) Increasing farmers ' enthusiasm for planting through policies

Farmers in Gaoyi County are interested in planting greenhouse vegetables, so the government should take advantage of the situation and introduce relevant policies to further improve the enthusiasm of farmers.

In the document issued by Gaoyi County in 2020, a series of incentive measures for individuals and collectives were proposed. For example, for the construction of more than 3 sheds of facility agricultural planting units funded by individual retail investors, 10% of the total investment will be awarded; For the introduction of superior vegetable varieties the top three new variety planting units will be rewarded with 120000yuan, 100000 yuan and 80000 yuan respectively. <sup>[4]</sup> (Agriculture, 2020) However, the assistance projects referred to in the policy generally require high levels of scale and do not apply to small-scale production of households, so half of the farmers in Shaojiaying Village said they did not receive subsidies. However, family planting is prone to the phenomenon of backward supporting facilities, shortage of funds and unstable income. It is suggested that government departments should increase subsidies to provide effective financial support for farmers

## 5. Summary

This paper studies the planting mode of greenhouse vegetable farmers in Shaojiaying Village of Gaoyi County to explore the planting mode of greenhouse vegetables, mainly in the form of questionnaire. These are the targeted measures concluded:

(1) Multilateral efforts to improve the quality of workers

(2) Promote land transfer from the institutional level

(3) Policy support.

## Discussion

The Chinese government has played an important role in promoting greenhouses, such as establishing cooperatives, providing subsidies and insuring crops to minimize the loss<sup>[5]</sup>(He, 2022). However, as I mentioned above, there are still the following difficulties in the promotion of greenhouse technology.

The implementation of greenhouse planting technology may lead to incomprehension from the villagers. Most villagers, especially the elderly, will take a wait-and-see attitude towards the new technology and new management mode. However, the village head or the person in charge can let the people who agree to the trial try it first, and then expand it after it is successful. For example, under the correct leadership of the government, Dongliangzhuang Village in Gaoyi County has established a specialized agricultural cooperative based on the transfer of land, which has introduced advanced technology, improved planting efficiency and increased farmers' income <sup>[6]</sup> (Niu, Li & Wang, 2014).

Based on the research, we suggest people trust the government and work with it. High-tech intellectuals can go to the countryside to instruct farmers. Farmers should be brave enough to accept new things, and village leaders should make reasonable plans for the village.

In short, the prospect of greenhouse vegetable planting in Gaoyi County is prosperous. Hopefully, the analysis of Gaoyi County can provide relevant reference for greenhouse planting in other parts of the country and provide consumers with more high-quality green vegetables!

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