Review

Study on rape planting willingness of rural households in Sichuan Province and its influencing factors

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Rape production of Sichuan Province plays a significant role nationwide. Analysis on planting willingness in rape of rural households in Sichuan Province is crucial in guiding the development of rape industry and oil industry. By using of research data from 304 rural households in three major growing areas of rape in Sichuan, this paper has conducted an empirical analysis on the planting willingness in rape of rural households in Sichuan Province via Logit model. The results show the planting willingness of rural households which are prominently affected by the age and the educational level of rural households, net income of planting rape for the year before, counter-disaster capability and sales channel. It also shows the overall planting willingness in rape which is strong and that the development of rape industry should be market-oriented, giving full play to professional cooperative organizations. Meanwhile, equal attention should also be attached to strengthening agricultural security and counter-disaster capability.

Key words: Rape, planting willingness, influencing factor, analysis, households.

INTRODUCTION

Vegetable oil is a daily necessity and important source of calorie intake. Rape plays a significant role among oil crops worldwide. It is not only the source of fine edible vegetable oil and protein but also indispensable industrial raw material, with more than ten processed products. Sichuan Province is one of the major rape producing areas in China, with its total annual output of rapeseed ranking among the first nationwide, scattering in the cities such as Deyang, Mianyang, Meishan, Suining, Neijiang and so on. Rape production in Sichuan possesses a crucial position nationwide. The area of rapeseed cultivation in Sichuan in the year of 2011 is 964,000.25 hectares, with an output of 2.1437 million tons and 2223.2 kilograms per hectare, accounting for 21.6% of total rape production in China, being the second largest major rape producing province. With the improvement of people's living standards and ever increasing awareness of health, people have attached greater importance not only to the

demand for edible oil, but the quality of it as well. However, factors such as rising labor cost, have caused shrinking rape production and cultivation areas in recent year. Rural households are the main business decision-makers, whose planting willingness has, to a large extent, determined the production capacity of rape. Therefore, it is of profound significance to study planting willingness of rural households so as to resolve the hard nut of imbalance between supply and demand and increase rural households' income.

LITERATURE REVIEW

Many scholars have made in-depth researches on the factors that affect the production and management willingness of rural households. Broadly, there are mainly two aspects. One is to study the operational behaviors of
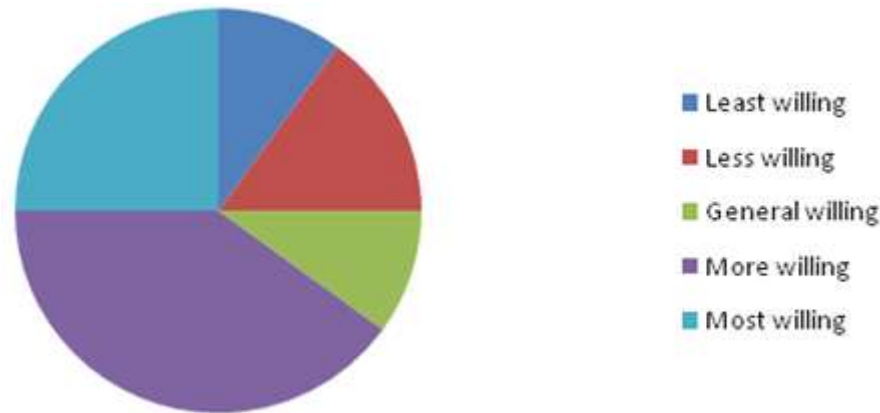
Figure 1. Distribution of Rural Households' Planting Willingness of Rape.

market entities (e.g Zhou Jiehong, 2006; Wang Jun, Zhang Yuejie, 2009; Chen Yusheng et al, 2009) from the angle of social psychology, based on the Theory of Planned Behavior (TPB) of Ajzen (1977;1991). Theory of Planned Behavior (TPB) consists of five factors, namely, attitude, subject norm, perceived behavioral control, behavior intention and behavior. According to TPB, Chen Yusheng et al (2009) established models on factors that affect production willingness in certified environmental-friendly vegetable and organic vegetable respectively. Results show that individual traders themselves are the biggest obstacles that affect the quality and value of vegetables and that enterprises are the real propellers. Liu Fang et al. (2010) took sasanqua industry in Guangdong Province for example, making an empirical study on the production willingness of rural households and its influencing factors. The results find that the sense of responsibility of rural households on food safety, food quality supervision mechanism and market prospect of sasanqua planting have a positive influence on rural households' planting willingness of it. Based on TPB, Yao Zengfu and Zheng Shaofeng (2010) conducted an analysis on the micro research data of 378 households in Hei Longjiang Province by use of factor analysis and SEM, concluding that among the endogenous factors that affect the production willingness of large rural households, behavior, subject norm and perceived behavior control have a significant positive correlation.

Another is, on the basis of hypothesis of rational man, who established a model to study economic behaviors of market entities, with a priority of seeking maximum economic profits, taking rural households as rational economic men. Economic models mainly adopted include Logistic Model (e.g Li Dongmei, 2009; Zhou Qingming, 2009; Luan Liming, Guo Qinghai, 2011; Zhu Shiyin, 2011; Li Shunguo et al., 2011; Zhu Hui et al., 2012), Tobit Model (Liu Chengfang, 2001; Li Zheng, 2011), Probit Model, Heckman Two-step Model (Liu Chengfang, 2001) and so on. Hu Bao, Wei Xin and Wang Meiqing (2005) established a Logit regression model on the factors that affect rural households' decision-making and willingness on restructuring farm products. The findings show that restructuring willingness on farm products are affected by the educational level of hard core of family members, non-agricultural factors, government support and so on. There are multiple factors that affect production willingness in soybean, including households themselves, their families and soybean production input (Luan Liming, 2011). Dai Yunyun and Wang Kai (2008) established a Logit model on the planting willingness in environment-friendly pears and got the conclusion that age of households, planting scale, commercialization and government support had a positive correlation. Rather, planting experience had a negative correlation. With regard to the study on the planting willingness in rape, Zhu Hui et al (2012) established a Logistic regression model,analyzing the factors of rural households that affect

the planting willingness of oil crop from the aspect of family characteristics, endowment of resources, economic conditions of families and other factors. Zhang Zongyi and Cao Guangqiao (2011) hold that low degree of mechanization of rape production has restricted the enlargement of its planting areas, and that the planting areas of rape has been squeezed out by ever widening mechanization of wheat.

In summary, despite numerous analyses on the planting willingness of rural households, studies on the planting willingness in rape in Sichuan Province, one of the major province of rape production, still fell short. However, these studies are of practical significance in guiding the development of rape industry in Sichuan Province and stabilizing the rape production nationwide.

Research hypothesis and general analysis on influencing factors of planting willingness

Research hypothesis

As the decision-maker of planting willingness, rural households are affected by both subject and object factors on their decision-making. Under such influences, rural households' economic behaviors are rational or irrational. The former is Schultz's rational peasant school. They hold that rural households will take the initiative to obtain and use market-concerning information to optimize resources allocation so as to seek maximum economic profits; the latter is Chayanov's organization-production school who hold the view that rural households are irrational economic men that go into production business just for the balance of consumption demand instead of pursuing the maximum profits.

The analysis of planting willingness of rural households in this paper is based on Schultz's perspective, namely, rural households are rational in decision-making of rape production, hoping to obtain the maximum profits through optimization of resources allocation.

General analysis of influencing factors

Characteristics of rural households of rape planting

First, influences on rape planting induced by human factors are reflected in the age and educational level of rural households. The planting willingness in rape may be affected by the age of rural households, which keeps their planting habits unchanged or restricts their ability to change. In the meanwhile, for those who don't have the experience of planting rape yet or those young and middle-aged people who are more likely to earn a better living as migrant workers, their planting willingness may drop. Next, if the higher the educational level of rural households are, the much more skills they will have, which, may thus have a negative impact on their planting willingness. However, if those rural households are to join the economic cooperation organization of rape planting, the facilitation of the economic cooperation organization on rape production and sales will exert a positive influence on increasing the planting willingness. Furthermore, as rape planting is a labor-intensive industry, initiative of rape planting and production will also increase for families who have more agricultural workforce.

Characteristics of rape planting

Generally, laboring efficiency of a rural household rises with the increase of mechanization level of agricultural production. In this way, rural households will also be more willing to take on agricultural production. So it is with rape planting. Meanwhile, affected by cultivation habits, rural households are more willing to keep planting the crops they have long been planting or have planted in recent years. Also, if they could gain a larger profit on this particular crop for the year before, then their planting willingness in the next year would be stronger. Nevertheless, because of the vulnerability and poor anti-disaster capability of agriculture, rural households are, for most of the time, acting as risk dodgers. Therefore, possessing the capability of preventing   and   countering

Table1. Selection of Variables and Its Indication.

Variable categories	Variable	Code	Assignment	Expected signs
Characteristics of rural household	Age	x^1	Specific values	+/-
	Educational level	x^2	Specific values	-
	Join agricultural cooperative organizations or not	x^3	no=0,yes=1	+
	Proportion of crop production income	x^4	Specific values	+
	Number of family agricultural labor	x^5	Specific values	+
Characteristics of rape planting	Number of agricultural machines	x^6	Specific values	+
	Planting rape for the year before or not	x^7	no=0 , yes=1	+
	Area of rape planting for the year before	x^8	Specific values	+
	Net income of rape planting for the year before	x^9	Specific values	+
	Rape production reduced or not over the past three years	x^{10}	no=0 , yes=1	-
	Measures to counter disaster	x^{11}	no=0 , yes=1	+
Characteristics of Market	Whether short of sales channels	x^{12}	no=0 , yes=1	+
	Whether have info on price and sales	x^{13}	no=0 , yes=1	+

disaster is a significant factor that influences rape planting willingness of rural households.

Characteristics of rape planting market

Rape market has an effect on rape planting willingness of rural households. A positive expectation of future market will increase the planting willingness of rural households by a large margin. The market expectation relies on the understanding of the rural households on the price and sales information which depends on whether the sales channel is smooth or not. This paper holds that this is the very factor that has a most direct impact on the rape planting willingness of a rural household.

An empirical analysis on factors influencing rape planting willingness of rural households

Sources of statistics

The data adopted in this paper are obtained from field trips in Qionglai, Santai and Xuanhan from Sichuan Province, in March, 2013 by Sichuan Agriculture Science Research Institute in their research project called "Study on Comparative Advantage of Rape in Sichuan". This research is conducted in seven countries in the above three counties, totaling 500 rural households, with the focus on the status quo of their basic family conditions and business operations and their planting willingness of rape. With leveled sampling, first goes the overall develo-

Table 2. The Factors of Rape Planting Willingness.

Independent Variables	B	S.E,	Wald	df	Sig.	Exp (B)
Age （x^1)	-0.037**	0.049	0.587	1	0.043	0.963
Educational level （x^2)	-0.459*	0.270	2.885	1	0.089	0.632
Join agricultural cooperative organizations or not （x^3)	0.835	1.196	0.488	1	0.485	2.305
Proportion of crop production income （x^4)	5.344	3.476	2.363	1	0.124	209.355
Number of family agricultural labor （x^5)	0.389	0.463	0.705	1	0.401	1.475
Number of machines （x^6)	6.970	28096.505	0.000	1	1.000	1063.699
Rape planting areas for the year before （x^8)	-0.114	0.314	0.131	1	0.717	0.893
Net income of rape planting for he year before （x^9)	0.001**	0.001	3.861	1	0.049	1.001
Rape production reduced or not in the year before （x^{10})	-0.794	1.073	0.547	1	0.459	0.452
Anti-disaster measures （x^{11})	2.735**	1.254	4.756	1	0.029	15.417
Whether short of sales channels （x^{12})	0.518**	0.209	6.113	1	0.013	0.596
Whether having info on price and sales （x^{13})	2.488	1.566	2.525	1	0.112	12.035
Constant	-3.683	28096.505	0.000	1	1.000	0.025
Chi-square		8.062				
Likelihood value of -2 logarithm		44.020				
Degree of freedom		8				
Level of significance		0.000				

Note: 1. * stands for being significant above 10% of confidence level, ** stands for being significant above 5% of confidence level, *** stands for being significant above 1% of confidence level. 2. Whether the households plant rape for the year before stays invariable to decision-making on cases, thus removed.

pment of rape planting in these areas from local government, next the sample major towns and the major counties in these towns. It was a one-to-one research. 304 rural households are effective samples.

The research suggests that the overall planting willingness in rape is fairly strong. 75% of them are willing to keep growing rape, including 25% of them being most willing, 40% of them being more willing and 10% being generally willing (see below).

Modeling

From previous analysis, it shows that multiple factors have impact on the rural households' planting willingness in rape. For quantitative analysis, linear regression model is most common used. However, the independent variable, namely, planting willingness, and other induced variables are not continuous variables but classified variables. Therefore, Logit model is adopted in this paper to conduct regression analysis.

Logit model is a kind of discrete choice model that assumes time is fit for cumulative logistic probability function. In the binary logistic model, whether the rural households are willing to plant rape is the induced variable, being 0, 1. Then the probability of rural households willing to plant rape (Y=1) is p, while the probability of those who are unwilling to plant rape (Y=0) is 1-p. So the Logit model is showed as follows:

$$p = \frac{\exp(\beta_0 + \sum_{i=1}^n \beta_i x_i)}{1 + \exp(\beta_0 + \sum_{i=1}^n \beta_i x_i)}$$

In this model, $x_i Y i = 1, 2 \| \ln Y$ is the factor that affects the rural households' planting willingness of rape, $\beta_i Y i = 1, 2 \| \ln Y$ is the solution parameter.

Selection of variables and its indication

According to the general analysis of factors that influence

rural households' planting willingness in rape, the induced variable is whether the rural households are willing to continue planting rape or not. The independent variables are set to include the ages and educational level of rural households, whether the rural households have joined agricultural cooperative organizations, proportion of crop production income, the number of agricultural labor force in a rural household, the number of agricultural machines, whether the households have planted rape for the year before, the area of rape planting for the year before, net income from rape planting for the year before, whether the output in the past three years has reduced, whether there are any measures to counter disaster, whether there are sales channels available, whether the rural households have obtained enough information on price and sales. These have covered three kinds of variables, namely, the characteristics of rural households, the characteristics of rape planting and the characteristics of market.

Analysis on model results

The binary Logit regression model is conducted via SPSS. The factors that affect rural households' rape planting willingness are as follows.

In general, analysis of the model shows that factors including the age and educational level of rural households, net income from rape for the year before, whether the households are equipped with counter disaster measures and whether they are short of sales channels have the most significant impact on households' planting willingness in rape. Concretely speaking:

In the variables of characteristics of rural households, the age stays significant above the 5% of confidence level, signed "-", indicating that rape planting willingness gets weaker when the households get older. This probably results from the fact that the physical conditions of them are getting worse to meet the requirements of long hours of laboring and labor intensity that rape planting needs when they are getting older. The education level has a negative correlation with their planting willingness   above 10% of confidence level, the same with the expected sign.

This is mainly due to the fact that those who are equipped with higher educational level are more willing to devote their time and energy to non-agricultural industry, as the investigation shows. Those young and middle-aged people are more likely to work outside their hometowns to improve their living standards. As the variable of whether the households join the agricultural cooperative organization have a positive correlation with planting willingness as expected but does not pass the significance test, then this variable can not increase the planting willingness in rape. Nowadays the agricultural cooperative organizations are mostly large individual households instead of small households that can unite with one another to face up with one large market together. Large households with scale effect have a relatively strong planting willingness while small households do not. Proportion of crop production income has a positive impact on the rape planting willingness, though it does not pass the significance test. The larger the proportion is, the greater the significance of rape planting are to households. Thus households will be more dependent on rape planting. Hence this is a very crucial factor that affects the rape planting willingness. The number of family labor force has a positive correlation with rape planting willingness, but it does not pass the significance test due to the fact that the improvement of planting environment and facilities does not mean it will also increase the planting willingness of households. It is the same with the correlation between the number of machines and planting willingness in rape. The improvement in this regards only indicates an improvement in the overall agricultural production capacity.

In the variables of characteristics of planting, the planting area for the year before has a negative correlation with the planting willingness, opposite to the expected sign. This is probably because the income from rape planting falls short of their expectation. As it passes the significance test, then it will not affect the planting willingness. However, the net income from rape for the year before has a positive, significant correlation with planting willingness. This is obvious profit-driven. A good profit for the year before convinces the households that they could earn good profits this year. The coefficient of this variable is 0.001 which indicates that the rural households are generally rational that they will not increase their planting of rape merely because they earn a good profit the year before. Similarly, if the rape output for the year before declined, the planting willingness will definitely lower. It does not pass the significance test mainly due to the fact that rural households might capture the opportunity that other households reduce their planting to increase their own, thus raising their profits. The variable of whether there are any counter-disaster measures has a positive correlation with planting willingness and passes the significance test above 5% of confidence level. This demonstrates that agricultural technology that can effectively prevent natural disaster and agricultural insurance that can lower the losses are of significance for the development of agriculture.

In the variables of market characteristics, whether they are short of sales channels has a significant correlation with planting willingness. That is to say, when sales channels are smooth enough, the rural households are more willing to grow rape. The better the sales are, the more initiative of growing rape they have. Similarly, the knowledge of price and sales information has an influence on the rape planting willingness. Although it does not pass the significance test above the 10% of the confidence level, market information has a direct impact on the sales channels. Therefore it is still a very important factor that affects the rural households' planting willingness in rape.

CONCLUSION AND GUIDANCE

Conclusion

From previous analysis, the overall rape planting willingness of rural households are strong, which, at present, does not need any extra publicity and promotion from the government. The age and educational level of rural households have a negative correlation with the pla-

nting willingness of rape. With the improvement of rural educational level and increase of migrant workers, it could be forecasted that the number of rural households planting rape would decrease to some extent in the future, but whether this drop will exert a negative influence on the development of rape industry or not remains to be further explored. Although the number of agricultural machinery is not directly correlated with the planting willingness of crops, the opportunity cost for purchasing this machinery and the specificity of these assets may, to some extent, set some restrictions on the rural households with these assets in hands when shifting their planting varieties, thus affecting their planting willingness. Their income for the year before has a direct impact on their future planting willingness. However, analysis shows that most of the rural households can make rational choices, while few people follow suit. Those who are equipped with counter-measures against disaster can, to a large extent, increase the initiative of rural households in planting rape; after all, peasants are good at circumventing risk. In addition, whether the sales channel is smooth is another crucial factor affecting the rape planting willingness of rural households.

Guidance

Through analysis, this paper has given following conclusions:

(1) Enough respect should be paid to rural households on their planting willingness towards different crops. Be market-oriented. Measures should be taken to encourage young and middle-aged fellows with relatively high educational level and competence of learning new knowledge and skills to engage into planting, managing and operating rape business and enhance the professionalism of the planting teams.

(2) Give full play to specialized cooperative organization to promote the rape planting and increase its efficiency; provide convenient sales channels and good transport conditions for rural households to lower the cost of

scouting market information and improve their sales competence.

(3) Agricultural protection can prominently strengthen the initiative of rural households. On one hand, the promotion and application of agricultural technology are needed to create more counter measures against disaster; on the other hand, the development of agricultural insurance is in need to expel the misgivings of rural households in planting rape, thus intensifying their willingness of engaging in agricultural production and rape planting.

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