Technical Demand of Commercial Paddy Farmers in the Context of Labor Transfer

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Abstract On the basis of document research, we summed up factors of technical demand of commercial paddy farmers to four aspects: individual characteristics of farmers, natural endowment of resources, factors related to risks, and information factor. Then, we put forward relevant hypotheses. From survey results of 241 farmer households in 4 southwestern provinces (regions), by the binary logistic regression analysis method, we empirically studied influences of the above four factors on technical demand of commercial paddy farmers. Results show that commercial paddy farmers like simple and high yield cultivation technique best, while individual characteristics of farmers, natural endowment of resources, factors related to risks, and information factors are major factors influencing different agricultural technical demand of commercial paddy farmers.

Key words Commercialized planting, Technical demand, Influence factors, Labor transfer

Situated in remote hills or mountainous areas and limited by natural, economic and cultural factors, most areas of China's four southwestern provinces (regions) are backward in terms of rice production methods and farming system, and production benefit is universally low. In recent years, with rapid development of industrialization and urbanization and drive of comparative advantages, more and more labor forces choose to work outside; rice production suffers great brunt; there is a serious shortage of young labor forces and aging trend of labor forces is being aggravated; and labor cost constantly rises. Influenced by the above factors, more and more paddy farmers turn to the self-contained production. Rice is the most important grain crop in China and its commercial supply directly relates with China's grain security. In the context of current much rural labor transfer, too high labor cost leads to low rice production benefit[1], and active use of new technology becomes a major approach for commercial paddy farmers to adapt to changes of the market. In view of these, technical demand of commercial paddy farmers is surveyed, in the hope of greatly enhancing pertinence of agricultural sci-tech policies and agricultural technologies, and effectively satisfying technical demand of rice production. This is of great theoretical and practical significance to improving production enthusiasm of commercial paddy farmers and guaranteeing normal supply of China's rice.

1 Brief introduction of documents and research hypotheses

Speeding up transformation of agricultural sci-tech achievements is the foundation of improving agricultural productivity and promoting agricultural development. However, at current stage, the contribution rate of China's agricultural science and technology to agricultural growth is lower than 40%, far less than 70% to 80% in developed countries[2]. At present, domestic researches in agricultural technologies mainly are carried out in two aspects: one the adoption activities of technology and its influence factors, mainly including traditional technology, adoption of different types of technologies and influence factors; the other is adoption of technology or demand willingness, mainly including key demand points, order of priority and influence factors. The highly typical conclusions mainly include: (i) there is certain difference in the influence of sex, age, educational level, family population, income and operation scale on different agricultural technical demands[3-5]; (ii) in the case of incomplete information, risk factor, cost for obtaining information, degree of part-time degree, and technical obtaining approach, affect farmers' technical demand in various degree[6-7]. Apart from these, some scholars carried out researches on technical demands of farmers in different regions. Results show that crop cultivation farmers hope that government can offer free agricultural technical service[8]; influenced by income and market risk, farmers in developed regions show strong demand for modern biotechnology like new cultivation technology, while farmers in underdeveloped regions show strong demand for traditional agricultural technological products, such as pesticides and fertilizers, *etc*[9]. In view of strategic position of rice in China's grain security, more and more scholars start to research demand of rice planting technologies. It is found that paddy farmers have the strongest demand for new variety technology and prevention and control of plant diseases and insect pests; the difference in different technical demands is mainly influenced by educational level, age, family size, per capita income, proportion of people engaged in farming, information source channel, and whether they have received agricultural technical training[10-12].

On the basis of document research and in combination with qualitative analysis of actual survey, we summed up factors of

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technical demand of commercial paddy farmers to four aspects: individual characteristics of farmers, natural endowment of resources, factors related to risks, and information factor. Then, we put forward relevant hypotheses:

H1: Individual characteristics of commercial paddy farmers influence their technical demand for rice production.

H2: Farmers' natural endowment of resources influences their technical demand for rice production.

H3: Risk (resulted from adoption of new technology) resistance ability of commercial paddy farmers influences their technical demand of rice production. The higher the risk resistance ability, the higher the demand for rice production technology.

H4: Different sources of rice planting technology have different demands for rice production technology.

2 General information of sample farmers and their technical demands

2.1 General information of sample farmers Compared with self-contained paddy farmers, commercial paddy farmers have no clear and uniform definition by now. In combination of natural endowment of resources and characteristics of economic development in 4 southwestern provinces (regions), commercial paddy farmers in this study refer to commercial rice suppliers who increase their family income through selling rice after satisfying rice demand of their families. With full consideration of difference in geological environment and economic development level, we surveyed 12 cities in 4 southwestern provinces (regions), Kunming and Yuxi in Yunnan, Jianyang, Dujiangyan and Chengdu in Sichuan, Guilin, Liuzhou, and Beihai in Guangxi, Liupanshui, Zunyi, Southeast and Kaili of Guizhou. We inquired about 600 farmer households, among whom 241 ones (41 in Yunnan, 38 in Sichuan, 66 in Guangxi, and 96 in Guizhou) satisfy the definition of commercial paddy farmers.

Among the commercial paddy farmers, heads of households whose age is below 20 or in the range of 21 to 30 only account for 2.5% and 10.4% of the total surveyed households; those whose age is in the range of 31 to 40, 41 to 50 and above 50 take up 26.1%, 37.8% and 23.2% respectively. It indicates that most people engaged in farming are old ones. The rice production takes on a distinctive feature of shortage of young labor forces and ageing trend. Among the surveyed farmers, male ones account for 71.8% and female ones account for 28.2%, which is mainly connected with traditional labor division model in rural areas and male ones carry out more field works; in educational level, 12.2% are illiterate, 33.6% receive primary school education, 34.5% receive junior middle school education, 14.7% receive senior middle school education, and only 5% receive college or above education. Survey results indicate that most commercial paddy farmers have low educational level; 73.86% people are (very) healthy and 9.9% are in bad health, which is related to heavy work of rice production.

2.2 Technical demand of commercial paddy farmers In the background of much rural labor transfer, commercial paddy farmers have urgent demand for simple and high yield cultivation technique (50.6%), followed by new varieties (46.1%), prevention and control of plant diseases and insect pests (45.2%), new pesticide (36.5%), agricultural information technology (34%) and new fertilizer (30.7%); but they have weak demand for technology of testing soil for formulated fertilization and weed prevention and control technology, as shown in Fig.1. which is inconsistent with results of other surveys[2, 11-12], indicating that technical demand of commercial paddy farmers is different from other farmer households. Strong demand for simple cultivation technology and high yield cultivation technology is mainly because that the rice production belongs to a labor intensive industry and needs much labor. In this situation, with much rural labor transfer, the rice production is faced with serious shortage of labor forces. Survey results show that 28.98% farmer households believe that shortage of labor is one of problems demanding prompt solution in current rice production. In addition, with much rural labor transfer, rural labor cost increases greatly, thus simple cultivation technology becomes the one urgently needed by commercial paddy farmers. With rise of rice production cost, to increase income from rice production, we have to rely on the yield. Therefore, the high-yield cultivation technology is also urgently demanded by commercial paddy farmers. In general, commercial paddy farmers have strong demand for new rice planting technologies. With further social and economic development, the demand of commercial paddy farmers for new planting technologies will also increase.

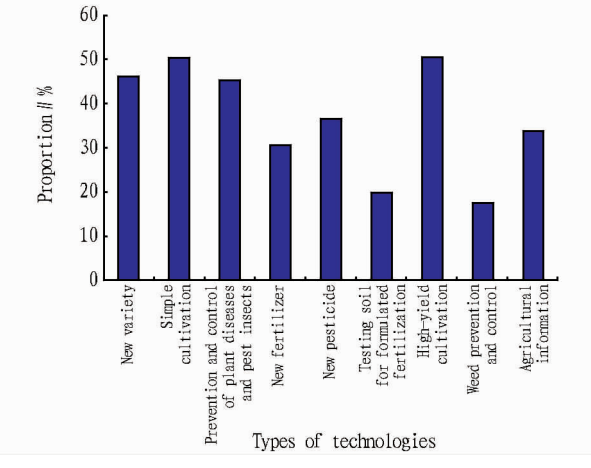

Fig.1 Proportion of technical demand of commercial paddy farmers

3 Analysis on factors influencing major agricultural technical demand of commercial paddy farmers

3.1 Selection of variables On the basis of researches carried out by other scholars previously, research hypotheses, as well as our survey, we selected 15 explanatory variables. Values of explanatory variables are listed in Table 2.

3.2 Research models Based on technical demand analysis in Section 2.2, we took urgently needed simple cultivation technology and high-yield planting technology as research objects,

and established simple cultivation technical demand model and high-yield cultivation technical demand model respectively for commercial paddy farmers. According to variable values listed in Table 2, the theoretical models are separately:

Table 1 Variables and their values for commercial paddy farmers' major agricultural technical demands

Model variable	Definition	Value
Characteristics of paddy farmers	Gender	0 = Female; 1 = Male
	Age	1 = Below 20 years old; 2 = 21 to 30 years old; 3 = 31 to 40 years old; 4 = 41 to 50 years old; 5 = above 50 years old
	Educational level	1 = Illiterate; 2 = Primary school; 3 = Junior middle school; 4 = Senior middle school or secondary school; 5 = college and above
	Health status	1 = Very healthy; 2 = Healthy; 3 = Normal; 4 = Bad; 5 = Very bad
Natural endowment of resources	Proportion of people engaged in farming	Total number of people engaged in farming divided by total number of family members
	Rice planting area	As per actual value
	Topography	1 = Mountain areas; 2 = Hills; 3 = Dam areas
Factors related to risks	Proportion of income from rice	Income from rice divided by agricultural income
	Annual per capita income	As per actual value
Information factor	Received agricultural technical training or not	0 = No; 1 = Yes
	Technology comes from agricultural technical popularization	0 = No; 1 = Yes
	Technology comes from radio and telephone	0 = No; 1 = Yes
	Technology comes from friends and relatives	0 = No; 1 = Yes
	Technology comes from family experience	0 = No; 1 = Yes
	Technology comes from seed company	0 = No; 1 = Yes

Model I: whether commercial paddy farmers demand simple cultivation technology = (characteristics of farmers, natural endowment of resources, factors related to risks, and information factors) + random disturbance term.

Model II: whether commercial paddy farmers demand high-yield cultivation technology = (characteristics of farmers, natural endowment of resources, factors related to risks, and information factors) + random disturbance term.

Since whether commercial paddy farmers adopt certain agricultural technology is a 0 – 1 binary dependent variable (1 for adoption of certain agricultural technology, and 0 for not adoption), we adopt binary logistic regression analysis to carry out parameter estimation:

$$P = \frac{e^{b_0 + b_1 x}}{1 + e^{b_0 + b_1 x}} + e \quad (1)$$

where, b_1 and b_0 are coefficient and constant of independent variable x, and e is the natural logarithm.

When the variables include more than one independent variables, the model can be converted into:

$$P = \frac{e^{Z}}{1 + e^{Z}} + e_i \quad (2)$$

where,

$$Z = b_0 + b_1 x_1 + b_2 x_2 + \cdots + b_n x_n \quad (3)$$

In formula (1) to (3), P refers to the probability of commercial paddy farmers' adoption of certain technology; b_i signifies the regression coefficient of the i th influence factor; n stands for number of influence factors; x_i is independent variable and refers to the i th influence factor; b_0 represents regression intercept; and ei stands for random disturbance term.

3.3 Model checking of influence factors We separately carried out binary logistic regression of surveyed data for the above two theoretical models using SPSS. 17. 0 software. We adopt "inverse screening" data processing method, specifically, we introduce all explanatory variables into regression equations and conduct analogue computation, reject the most insignificant variables of Wald value, then conduct regression, till all explanatory variables reach significant level, and the final model estimation results are listed in Table 3.

3.4 Model result analysis

3.4.1 Individual characteristics of commercial paddy farmers influence their technical demand for rice production. Male and old farmers have stronger demand for simple cultivation technology, while those with high educational level have weaker demand for simple cultivation technology, but have stronger demand for high-yield cultivation technology. This is possibly because rice production is a labor intensive industry. The traditional idea of "men are bread winners, women are house keepers" is deeply rooted in rural areas. Men shoulder more work in decision making on rice planting matters and spend much time and effort in rice planting, so they hope to reduce their work

through new technology. Older paddy farmers also demand simple cultivation technology under the pressure of bad physiques and weak physical strength. Those farmers who have received higher level education do not have adequate time and effort to pay close attention to rice production, but they pay more attention to planting result, so they have higher demand for high-yield cultivation technology.

Table 2 Estimation results of model parameters

Model	Variable	B	S.E	Wald	Sig	Exp (B)
Simple cultivation technology	Age	0.305	0.162	3.573	0.059 *	1.357
	Gender	0.574	0.345	2.763	0.096 *	1.775
	Educational level	−0.779	0.176	19.598	0.000 * * *	0.459
	Proportion of people engaged in farming	−1.472	0.729	4.074	0.044 * *	0.229
	TV and radio	0.787	0.403	3.809	0.051 *	2.196
	Constant	0.733	1.058	0.480	0.488	2.081
High-yield cultivation technology	Topography	−0.594	0.195	9.299	0.002 * * *	0.552
	Educational level	0.238	0.138	2.986	0.084 *	1.269
	Proportion of income from rice	1.767	1.006	3.082	0.079 *	5.852
	Participation in agricultural technical training	−1.212	0.325	13.891	0.000 * * *	0.298
	Friends and relatives	−0.934	0.326	8.201	0.004 * * *	0.393
	Seed company	0.876	0.427	4.208	0.040 * *	2.401
	Constant	0.821	0.534	2.360	0.124	2.273

Note: *, * * and * * * respectively stand for significance at 10%, 5% and 1% levels.

3.4.2 Farmers' natural endowment of resources influences their technical demand of rice planting. Those commercial paddy farmers whose proportion of people engaged in farming is large have small demand for simple cultivation technology. This is possibly because they have sufficient labor forces to satisfy their demand of rice production. Compared with commercial paddy farmers in dam areas, those in mountain areas or hilly areas have higher demand for high-yield cultivation technology. This is mainly because the topography has a great influence upon rice production mode and income. Also, different topography exerts influence on form and difficulty of adoption of technology. Mountain and hilly areas are blocked in information, so a lot of technologies that have been popularized in plain or dam areas fail to spread in these areas. As a result, farmers in these areas rely much on high-yield cultivation technology.

3.4.3 Factors related to risks influence technical demand of commercial paddy farmers. Those commercial paddy farmers whose income mainly comes from rice production have stronger demand for high-yield cultivation technology. This is possibly because those farmers deeply understand that income from rice production plays an important role in increase of their family income. In addition, those farmers have the ability of bearing risks resulted from adoption of new technology.

3.4.4 Information factor has a significant influence on demand of commercial paddy farmers for different rice production technologies.

(i) Commercial paddy farmers whose technology comes from radio and television have stronger demand for simple cultivation technology. This is possibly because those farmers prefer to trust in authoritative information from radio and television, and are more willing to adopt those technologies introduced on radio or television.

(ii) Commercial paddy farmers whose technology mainly comes from friends and relatives have weaker demand for high-yield cultivation technology. This is possibly because use of high-yield cultivation technology will directly affect yield of rice, the investment risk is bigger, and commercial paddy farmers may dare to try only after they have practical feeling of benefit. At present, rice yield is universally low in 4 southwestern provinces (regions). The average per unit area yield is only about 7 477.05 kg/hm^2, having a big gap with 12 000 kg/hm^2 in China's Super Hybrid Rice "model field".

(iii) Commercial paddy farmers who have participated in agricultural technical training have weaker demand for high-yield cultivation technology. From the estimation value, it can be seen that those commercial paddy farmers who have participated in agricultural technical training are unwilling to adopt high-yield cultivation technology, possibly because small coverage, bad effect and mere formality of, as well as paddy farmers' distrust in current agricultural technical training. Our survey indicates that only 40.2% of the surveyed commercial paddy farmers have participated in agricultural technical training, and up to 62.7% of them reflect that the training effect is general or bad.

(iv) Commercial paddy farmers whose technology mainly comes from seed companies have stronger demand for high-yield cultivation technology. Seed companies have comprehensive understanding of variety traits and rice planting situations, so they can solve information asymmetry problem for commercial paddy farmers.

3.4.5 The influence of health condition, rice planting area, and whether technology comes from agricultural technical popularization is not significant on technical demand of commercial paddy farmers. This is possibly because farmers who are in bad health engage little in rice production and many samples with this characteristic are outside the range of this study. Survey results show that only 5.6% and 0.8% farmers whose health condition is bad and very bad plant and sell rice. Another reason is possibly that current agricultural technical popularization becomes a mere formality, the effect is bad, and farmers distrust agricultural technical popularization. In our survey, 63.49% villages have agricultural technical service stations, but only 3.72% and 20.21% farmers separately think that such stations play a good and better role in grain production, while

22.87% and 18.62% farmers think that such stations play a bad and worse role in grain production.

4 Conclusions

From the above analyses, we can reach following conclusions: (i) in the context of much rural labor transfer, the most urgently demanded technologies of commercial paddy farmers are simple and high-yield cultivation technologies; (ii) commercial paddy farmers with different individual characteristics and natural endowment of resources have different demands for technologies; (iii) source of rice production technology influence technical demand of commercial paddy farmers, so different agricultural technologies should adopt different propaganda and popularization methods.

References

[1] CHEN FB, DING SJ. The input-output in rice production and rice growers' demand on technologies: a study in provinces of Jiangsu and Hubei[J]. Journal of Agrotechnical Economics, 2007(6): 44 – 50. (in Chinese).

[2] WANG JX, QI ZH, YANG F, *et al.* Empirical study on influencing factors of farmers on main technical requirements of rice[J]. Rural Economy, 2010(10): 32 –36. (in Chinese).

[3] ZHAN JT, CHEN C. Effects of labor force transfer on farmers' agricultural technology choice[J]. Chinese Rural Economy, 2009(3): 75 –84. (in Chinese).

[4] GE JH, ZHOU SD, ZHU HG, *et al.* On farmers' behavior of adopting friendly environment technology[J]. Journal of Agrotechnical Economics, 2010(9): 57 –63. (in Chinese).

[5] LI SB, XU SY. Analysis on Farmers' agricultural technology demand influencing factors in current stage in China[J]. Journal of Agrotechnical Economics, 2009(4): 42 –47. (in Chinese).

[6] ZHU MF, LI NT. Behavior difference and countermeasures study of farmers' adopting agriculture new technology[J]. Journal of Agrotechnical Economics, 2001(2): 26 –29. (in Chinese).

[7] LI B, ZHANG JB, ZHANG YJ. Empirical Study on the impoverished farmers' wishes of agricultural science&technology needs and affecting factors[J]. Forum on Science and Technology in China, 2010 (5): 127 –132. (in Chinese).

[8] WANG Y, YING RY, ZHANG YG. Priority of agricultural technology service demand of farmers in planting in Jiangsu Province[J]. Forum on Science and Technology in China, 2007(11): 123 –126. (in Chinese).

[9] LI YH, LUO JL, FENG G. Comparative analysis on farmers' agricultural technology demand in developed and undeveloped area[J]. Forum on Science and Technology in China, 2009(8): 120 – 125. (in Chinese).

[10] LIAO XY, CHEN QG, WANG L, *et al.* Priority of farmers to rice science and technology demand[J]. Chinese Rural Economy, 2004(11): 36 –43. (in Chinese).

[11] CHEN B. Behaviors of peasant households adopting new rice production technologies and participating in rice integration[D]. Yangzhou: Yangzhou University, 2005. (in Chinese).

[12] YU YH, ZHANG JY. Willing of farmers' adopting rice IPM technology and influencing factors[J]. Chinese Rural Economy, 2009(11): 77 –86. (in Chinese).

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[13] CHEN G, ZHAN ZM, LIAO XH. A study on regional difference of capital market in China[J]. China Soft Sciences, 2003(9): 118 – 122. (in Chinese).

[14] HUANG YH. Household registration system: analysis on pathway of coordinating urban-rural comprehensive supporting reform[J]. Probe, 2008(2): 176 –180. (in Chinese).

[15] LI ZN, PAN WQ. Econometrics[M]. The 2nd ed. Beijing: Higher Education Press, 2005: 329 –334. (in Chinese).

[16] LIN L. Thinking on several questions about coordinating urban-rural supporting reforms test area[J]. China Urban Economy, 2007(8): 16 –18. (in Chinese).

[17] DU WQ. Coordinating urban-rural pattern[J]. Beijing Planning and Construction, 2010(4): 12 –13. (in Chinese).

[18] WANG CJ, YANG P, ZHENG ZG, *et al.* Regional coordinated development and governmental social service function[J]. Journal of Chongqing Technology and Business University: West Forum, 2007, 17(2): 1 –5. (in Chinese).

[19] XU ZZ. Discussion on new pattern for urban-rural coordinated development in China[J]. Newsletter about Work in Rural Areas, 2009(1): 39 –40. (in Chinese).

[20] YIN HS. Eight interactive mode for coordinating urban-rural development[J]. Theory and Reform, 2998(5): 82 –84. (in Chinese).

[21] ZHU DC, LI G. Systematic analysis of synthetic reform testing district[J]. Reform, 2008(3): 153 –157. (in Chinese).

[22] FANG SH, WANG WN, HUANG HQ. On increasing farmers' income and expanding rural consumption[J]. Management World, 2011(5): 66 –80. (in Chinese).

[23] ZHAO CY, XIA Y. Analysis on influencing factors of urban-rural economy coordinated development[J]. Review of Economic Research, 2008(27): 2 –6. (in Chinese).