Factors Affecting Grape Cultivation Technology Adoption of Tibetan Farmers in Deqin county, Yunnan Province, P.R. China

ปัจจัยที่มีผลต่อการยอมรับเทคโนโลยีการปลูกองุ่นของเกษตรกรชาวทิเบต ในเขตเต๋อจิง มณฑลยูนนาน ประเทศสาธารณรัฐประชาชนจีน

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บทคัดย่อ: ประเทศจีนมีประวัติการปลูกองุ่นมาเป็นเวลานาน และพื้นที่ปลูกองุ่นในประเทศมีเพิ่มขึ้นอย่างมากในระยะเวลาสองสามปีที่ผ่านมา เขตเต๋อจิง ในมณฑลยูนนานเป็นพื้นที่ใหม่ที่ได้รับการพัฒนาให้เป็นพื้นที่ปลูกองุ่นเนื่องด้วยสภาพทางธรรมชาติที่เหมาะสมและวัฒนธรรมของชนเผ่าจีนทิเบตที่โดดเด่น เพื่อให้มีการผลิตที่สอดคล้องกับนโยบายการพัฒนาการเกษตรในพื้นที่ จึงมีความสำคัญที่จะศึกษาการยอมรับและปัจจัยที่มีผลต่อการยอมรับเทคโนโลยีการปลูกองุ่นของผู้ปลูกองุ่นในพื้นที่เต๋อจิง ประชากรเป้าหมายในการศึกษาคือ เกษตรกรผู้ปลูกองุ่นชาวจีนทิเบตในเขตเต๋อจิง จำนวน 2,200 คน กำหนดขนาดกลุ่มตัวอย่างจำนวน 338 คน สุ่มตัวอย่างโดยเทคนิคการสุ่มอย่างง่าย เครื่องมือในการเก็บรวบรวมข้อมูลเป็นแบบสอบถามซึ่งผ่านการตรวจสอบค่าความเชื่อถือได้ของเครื่องมือ (มีค่า Cronbach's alpha เท่ากับ 0.938) วิเคราะห์ข้อมูลด้วยโปรแกรมสำเร็จรูปเพื่อการวิเคราะห์ข้อมูลทางสังคมศาสตร์ ผลการศึกษาพบว่า เกษตรกรมีการยอมรับในระดับมาก ในด้านการเลือกพื้นที่และดินที่ปลูก เทคนิคการปลูก วิธีการสร้างชั้นสำหรับองุ่น การจัดการองุ่นในฤดูใบไม้ผลิ การให้ปุ๋ย การให้น้ำ และการเก็บเกี่ยว และพบว่า อายุ ประสบการณ์นอกพื้นที่ รายได้ของครัวเรือน สัดส่วนของรายได้จากการผลิตองุ่น การศึกษา จำนวนแรงงานในครัวเรือน และระดับความพึงพอใจต่อการให้บริการของเจ้าหน้าที่ส่งเสริมการเกษตร มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 กับการยอมรับเทคโนโลยีฯ ของเกษตรกร

คำสำคัญ: การผลิตองุ่น การยอมรับ เทคโนโลยีการปลูกองุ่น เกษตรกรชาวจีนทิเบต ยูนนาน

Abstract: China has a long history in cultivating grape, and grape cultivated area also has been sharply increased in recent years. Deqin county is a newly developed grape growing area, which has unique plateau natural conditions and Tibetan cultural environment. In order to have optimal grape production that comply with the agricultural development policy of this area, it is necessary to study the adoption and factors related to the adoption of the Tibetan farmers in this county. The target population consisted of 2,200 grape farmers in the county and 338 samples were selected by simple random sampling technique. The questionnaire with reliability tested (Cronbach's alpha=0.938) is used for the data collection, and the data were analyzed by using the statistic program of social science research. The results of the research showed that Tibetan farmers in Deqin county have high adoption in "Land and soil select", "Planting techniques", "The method of built grape shelves", "Spring management techniques", "Fertilizer techniques", "Irrigation techniques", and "Harvest techniques". The study also found age, experience of being out town, household income, proportion income from grape, education, labor force number in a household, and satisfaction on service of technician, were directly affected to the Tibetan farmers' adoption.

Keywords: Grape cultivation, adoption, grape technology, Tibetan farmers, Yunnan

Introduction

Cultivation of grape had been started in China since thousands of years ago, and the area of grape cultivation has been increased sharply in recent years (Zhao, 2014). According to statistics of the ministry of agriculture, since 2011, China's fresh grape production has been the world's largest and by the end of 2015, China's grape cultivation area was 1,960,000 acre. Deqin county is located in the northwest of Yunnan Province which belongs to Diqing Tibetan Autonomous Prefecture. This prefecture is the only Tibetan autonomous prefecture in Yunnan Province, which locates in the middle of the Hengduan Mountains and bordered by the Tibet Autonomous Region in the northwest and Sichuan Province in the northeast. Diqing Prefecture is the upper reaches of the Salween, Mekong and Jinsha Rivers. There are three counties in this prefecture: Shangri-La City, Deqin county, and Weixi Lisu Autonomous County (See Figure 1). Although agriculture is important in this county, there are many limitations of agriculture development; such as poor transportation and backward agricultural infrastructure. People in this county make a living by planting corn, wheat, and rice. For many years, the rural economy is fall behind Yunnan Province's average (Deqin county, Government Operational Report, 2015).

Chinese experts have found that the Jinsha and Lancang Rivers valley in Deqin county is suitable for grape cultivation because of its weather, temperature, rainfall, sunshine duration, and water quality (He, 2012). In addition, the wine from this county is the best quality wine in China, even in world. With these reasons, since 2001, Deqin county government has begun to promote grape cultivation in the area by allocating a large amount of funds and formulating and implementing grape extension policy for the area. For the result, after ten years of extension, the government can expand grape cultivation areas. In 2015, there was about 2,277 acre of grape plantation. However, the government still needs to expand more grape area and also has future policy for the grape extension of the area.

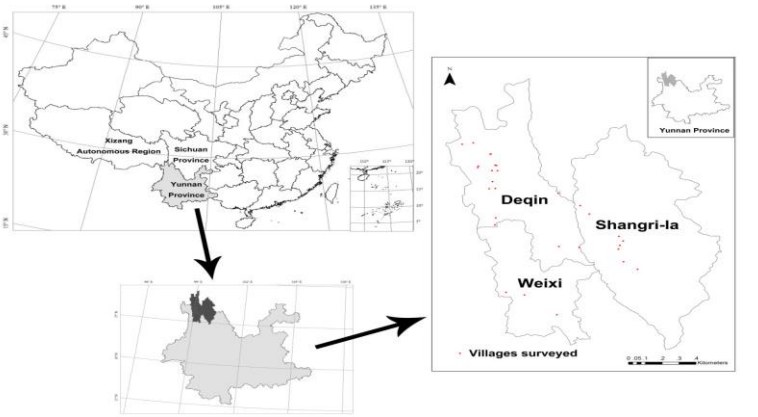

Figure 1. Location of Deqin county, Yunnan Province, P.R. China
Source: Ju, 2013. pp. 21

Since the grape extension system has been implemented in the area, there is no evaluation of the effectiveness of the extension system including farmers' grape cultivation technology adoption. With this reason, to realize farmers' grape adoption and factors related to the adoption are very important for Deqin government. Many researchers have tried to explain technology adoption in relation to personal characteristics and endowments, imperfect information, risk, uncertainty, institutional constraints, input availability, and infrastructure (Feder et al.1985; Foster and Rosenzweig 1995; Rogers, 2003). If the Deqin government has realized some factors related to the grape cultivation technology adoption of Tibetan farmers, they can be able to improve efficiency and effectiveness of the services on grape extension system.

Materials and Methods

Locale of the study

The research was conducted in two towns named Benzilan and Yunling of Deqin county. Benzilan Town is located in the southeastern of the county, on the side of the Jinsha River. There are five administrative villages (named as Benzilan, Dari, Yeri, Shusong and Duotong) with a total area of 1245 sq.km. Yunling Town is located in the southwest of Deqin county and the Lancang River which runs across the whole area from north to south. There were four villages (named Sinon, Xidang, Hongpo, and Guonan) in Yunling, and there were three villages (named Benzilan, Dari, and Yeri) in Benzilan, together with the total area of 942 sq.km. The two towns were selected based on three reasons. First, the areas are suitable for grape cultivation. Both of them are located in the valley of Jinsha River and Lancang River. Benzilan Town is on the side of the Jinsha River, and Lancang River runs across Yunling Township area. Second, both Benzilan and Yunling are typical Tibetan towns where 96% and 97% of their populations are Tibetan ethic groups, and Tibetan traditional culture was well preserved. Third, Benzilan is located along an important commercial and tourism route from ancient times to present. It is famous for the tourism resources including Meili Snow Mountain, Baimang Snow Mountain, and Jinsha River Grand Canyon. Tourists can easily visit grape orchard and purchase grape fruits. Yunling is the largest grape planting area, and it is an earliest grape adoption township of the county.

Data collection

The Tibetan farmers who already cultivated grape in Deqin county were the study subjects. According to the 2017 statistics of Deqin county Agricultural Bureau, there were about 2,200 Tibetan grape farmers in the county, and these farmers were the target population. The actual sample size of the 338 farmers was calculated by using Taro Yamane formula with 95% confidence level. The simple random sampling method was used to select the samples scattered in the above seven villages in both target towns.

Research tool

This study employed a questionnaire as a research tool. The questionnaire was consisted of two parts. The first part was about socio-economic background and information of grape cultivation of the farmers (e.g. gender, age, education, year of cultivated grape, vineyard size, experience being a village leader, experience of being out of town, household income, proportion income from grape, education, labor force number in a household, grape orchard distance, major transportation, frequency of guidance provided by technician, and satisfaction on service of technicians). The second part is a list of questions about grape cultivation technology adoption of the farmers. A 3-point scale question was used to determine the level of farmers' adoption; all the time (3), sometimes (2), never (1). Details of grape cultivation technology included land and soil selection, soil improvement, excavated depth and space of line and row of a grape tree, method of built grape shelve, bud picking, pruning, binding, bagging, weeding, fertilization, pest control, irrigation and harvesting.

To ensure the quality and feasibility of the questionnaire, the research tools were checked with its validity by 5 experts from both academic institutions (Maejo University, Yunnan Agricultural University, and Deqin Extension Center). The reliability of the questionnaire was checked by a try out survey of 30 Tibetan farmers in a town nearby the research site (named Yanmen Town). The questionnaire's reliability test with Cronbach's Alpha is 0.938, which mean the questionnaire was qualified to be used for collecting data (Kline, 2000).

Results and Discussion

Grape Cultivation Technology Adoption of Tibetan Farmers

The study found that there were almost the same numbers of male and female Tibetan grape farmers (50.1% and 49.9% respectively). More than one-third of them (34.9%) were in the age of 51 +. Almost half of the farmers (42%) had 7-9 years of experience in grape cultivation and 47% of them had vineyard size of less than 1 mu. (1 mu=0.165 acre). It was also showed almost two third of them (74.3%) had no experience of work or study out of town. The questionnaire indicated that 34.6% Tibetan grape farmers' gross household income were above 50,000 Yuan (about 7,400 US dollar, and there were 47% of them whose income from grape were 20-40%. It also showed that more than three quarters (75.4%) of their education were less than 6 years, and half of the farmers (52.1%) have 3-4 fulltime labor forces in their household. The data also indicated that more than half of the orchards (60.9%) were 1-3 kilometers from the village' grape selling point and more than half of them (66.3%) mainly transported their grape products by a truck. In addition, more than half of the farmers (52.1%) considered that the government extension workers could provide knowledge of grape whenever they needed. Almost half of them (44.4%)

indicated that the government extension workers performed good efficiency at work. Focusing on grape cultivation technology adoption. There are 10 issues that the farmers adopted. Those were land and soil select, planting techniques, method of built grape shelves, spring management techniques, autumn management techniques, weeding techniques, fertilizer techniques, pest control, irrigating techniques, and harvesting techniques.

By applying the Weight Mean Score (WMS) method, the criteria for interpreting the level of adoption are 2.3334-3=High adoption; 1.6667-2.3333=Medium adoption; 1-1.6666=Low adoption. It was found that in overall the farmers had high adoption of grape cultivation technology. The details are shown in Table 1.

When considering in the details, it was found that the farmers had high adoption on building grape shelve technology, whereas the lowest adoption was autumn grape management technology.

Factors affected the grape cultivation technology of the Tibetan farmers in Deqin county

Using regression analysis to analyze factors that affected grape cultivation technology adoption of the Tibetan farmers, it was found that age, experience of being out of town, household income, proportion income from grapes, education, labor force number in a household, and satisfaction on service of technicians were significantly affected the Tibetan farmers' adoption. The result of analysis was shown in Table 2.

Table 1. Level of grape cultivation technology adoption of Tibetan farmers in Deqin county

Grape technology	WMS	S.D.	Level of adoption
Land and soil selection	2.6435	0.4963	High
Planting technology	2.5769	0.5300	High
The method of building grape shelves	2.8245	0.3833	High
Spring management techniques	2.3898	0.5505	High
Autumn management techniques	2.1183	0.7847	Moderate
Weeding techniques	2.2968	0.6991	Moderate
Fertilizer techniques	2.5310	0.6471	High
Pest control	2.2544	0.7821	Moderate
Irrigating techniques	2.6420	0.4801	High
Harvesting techniques	2.5128	0.5222	High
Total	2.4790	0.5875	High

Table 2. Factors affecting the grape technology adoption of the Tibetan farmers in Deqin county

Independent Variable	Unstandardized coefficients Beta	Standardized coefficients Beta	Significant level (Sig) P
Constant	0.804	-	0.000
X_1 Gender	0.302	0.205	0.520
X_2 Age	0.701	0.668	0.000*
X_3 Year of cultivated grape	0.208	0.167	0.120
X_4 Vineyard size	-0.308	-0.265	0.342
X_5 Experience being a village leader	0.872	0.747	0.400
X_6 Experience of being out of town	0.901	0.884	0.000*
X_7 Household income	0.898	0.806	0.000*
X_8 Proportion income from grape	0.623	0.600	0.000*
X_9 Education	0.728	0.725	0.000*
X_{10} Labor force number in a household	0.703	0.690	0.000*
X_{11} Grape orchard distance	0.209	0.130	0.177
X_{12} Major transportation	-0.442	-0.208	0.068
X_{14} Satisfaction on service of technicians	0.696	0.598	0.000*
		F	Sig
R = 0.585[a]	R Square = 0.342	113.822	0.000[b]

*Significant difference at ($P<0.05$)

The results of Table 2 showed the relationship of X_1 gender, X_2 age, X_3 years of cultivated grape, X_4 vineyard size, X_5 experience of being a village leader, X_6 experience of being out of town, X_7 household income, X_8 proportion income from grape, X_9 education, X_{10} labor force number in a household, X_{11} grape orchard distance, X_{12} major transportation, and X_{14} satisfaction on service of technicians, all together explained Y with statistical significance (R=0.585, $P<0.05$). The relationship of variable group can explain variation of Y at 34.20 % (R^2=0.342, $P<0.05$). The regression model can be written as follows:

Unstandardized

$$Y = 0.804 + 0.302X_1 + 0.701X_2 + 0.208X_3 - 0.308X_4 + 0.872X_5 + 0.901X_6 + 0.898X_7 + 0.623X_8 + 0.728X_9 + 0.703X_{10} + 0.209X_{11} - 0.442X_{12} + 0.696X_{14}$$

And Standardized:

$$Y = 0.205X_1 + 0.668X_2 + 0.167X_3 - 0.265X_4 + 0.747X_5 + 0.884X_6 + 0.806X_7 + 0.600X_8 + 0.725X_9 + 0.690X_{10} + 0.130X_{11} - 0.208X_{12} + 0.598X_{14}$$

Among the 13 variables, there were 7 variables that were significantly related to the adoption. Those were age, experience of being out of town, household income, proportion income from grape, education, labor force number in a household, and satisfaction on service of technicians. It was found that household income is the highest, whereas the proportion income from grape is the lowest significantly related to the adoption. Discussion on the results were as follow;

Age-Literature review has shown that age negatively effect on the adoption because of veteran

farmers believe in their own experience (Mauceri *et al*., 2005). Younger farmers are more likely to accept new technologies and have a stronger willingness for trying new technologies (Alexander and Van Mellor, 2005). In Deqin county, the government made a great effort in grape extension from 2005 to 2012. Therefore, Tibetan farmers who had started planting grapes during this period had gained several good technical trainings and many onsite guidance (He, 2012). They also were strong laborers involved in agricultural production during this period of times. At present, also these farmers are on their 60s years old, still they are skilled laborers in grape cultivation since they are well trained, and have gained lot of knowledge and experiences on grape planting.

Experience of being out of town-In recent years, the Chinese government has speed up both infrastructure construction and public services in northwest Yunnan region. Therefore, Deqin county is rapidly exchanging with external development. Many local Deqin residents had migrated out of the two research towns to either Shangri-La City, Kunming, or even other cities outside Yunnan for their better education and jobs. The experience of going out for work has a significant impact on farmers' technology adoption behavior (Shi and Wang, 2013). With this reason, these farmers have higher level of acceptance of grape planting technology than the farmers who were never been moved out of the towns.

Household income-A key determinant of the adoption of a new technology is the net gained from adoption of the farmers (Foster and Rosenzweig, 1995). It also indicated that the high cost of agricultural technology has been found to be a constraint to technology adoption. Compared to the traditional crops, grape usually requires high investments for vine yard establishment. Farmers with higher household incomes had a higher adoption rate of grape techniques

Proportion income from grape-The higher dependency on technology, the higher adoption in the technology (Wei et al., 2015). The higher proportion of income from grape planting in a household income, the higher the rate of technology adoption. This is because these farmers are high dependent on grapes, and they hope to increase their incomes by adopting standard grape planting techniques.

Education-Ajewole (2010) found that the level of education has a positive and significant influences on adoption of the technology. A study by Rahm and Huffman (1984), who studied the role of human capital and factors that affected the adoption of reduced tillage in corn production, had found that farmers' education and experiences play a crucial role in enhancing the efficiency of the adoption. Education level of a farmer increases his ability of obtain and use information of grape cultivate technology. Therefore, education of Tibetan farmer in Deqin county has a positive influence on their decision of grape cultivate technology adoption.

Labor force number in a household-A larger household have more capacity to meet labor requirement during introduction of new technologies (Mignouna et al., 2011). The labor demands of a new technology have to match with the labor availability of the household. The cultivation of grapes requires more labor than traditional crops. Lacking of labor and ineffective management has negative impact on grape harvesting.

Satisfaction on service of technicians-This study had shown that availability of extension service plays a key role in Tibetan Farmers adoption in Deqin county. If farmers can always get information of technician about the new techniques of viticulture and the benefits they bring, it will facilitate the flow of

technology from innovators to farmers. In fact, the influence of extension agents can counter balance the negative effect of lacking formal education in the overall decision to adopt some technologies (Yaron *et al.*, 1992).

To enhance the Tibetan farmers' grape technology adoption in Deqin county, some recommendations were made for the central government, Yunnan provincial government, and also Deqin local government as follow;

1. Further strengthen education and agricultural training for the farmers. This study had found that frequency of guidance provided by technicians is highly affected the adoption. Thus, it is necessary for the Deqin government to maintain or increase and also improve quality of agricultural extension services. At the same time, it is important to increase the training of agriculture technology. Low educated farmers who were main labor forces in the area insisted that training course should be launched to the farmers continuously. In addition, local government should take advantage of the specific plan named "Yunnan Province on Further Strengthening the Counterpart Assistance to Diqing Prefecture" which is aimed to strengthen counterparts' support mechanism of "Three District, Three County" and "Three City, Three County". In this plan, cooperation between the Deqin government and agricultural research departments and universities in these cities will be promoted in order to transfer appropriate agricultural technologies to farmers in the area.

2. Both Yunnan and Deqin local government should motivate and assess the public agricultural technology extension systems in the county. As an important public service undertaking, agricultural technology extension cannot be separated from the strong support of finance and techniques at all levels. Local governments should make full use of supporting policies of the central government on the development of Tibetan areas. All related organization such as Deqin county Agriculture Bureau for Agricultural Development Projects in Tibetan, The Agriculture Department of Yunnan Province, and The Science and Technology Department of Yunnan Province should effectively collaborate to provide sufficient budget, human resources, and technologies to the farmers. For example, an active communication via mobile phone, network, and other ways to improve the efficiency of agricultural technology. At the same time, improve the performance appraisal mechanism of agricultural technicians, with the actual workload and work performance to farmers as the main assessment indicators, objectively and truthfully evaluate the performance of agricultural technicians, and disclose them to the public, accept public supervision.

Conclusion

In summary, the Tibetan farmers in Deqin county has high level of adoption in grape cultivation technology. This is because grape cultivation in this area is very intensive. Tibetan farmers had very limited land size. Because of geographical limitation where majority of the area is high slope mountainous area, there are only narrow pieces of land along the Jinsha and Lancang Rivers valley that are suitable for grape cultivation. Also, Tibetan farmers are naturally calm and patient, they usually devoted their labor for taking a good care of their grape. Remarkably, there were 7 factors (age, experience of being out of town, household income, proportion income from grape, education, labor force number in a household, and satisfaction on service of technicians)

significantly affected the Tibetan farmers' adoption. Hence, Deqin government should develop young farmers in the county on both of their formal education and grape experiences so they can be not only experience good grape farmers but also be labor force in rural Deqin development. In the same time, Deqin government should continuously and constantly develop effective and productive potentiality in grape extension to their technicians. So, these technicians will be important key persons in grape cultivation development in the county.

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