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Understanding Farmers' Adoption Decisions for New Cash Crops: Evidence from Xishuangbanna in Tropical China

Uwarunkowania zainteresowania rolników nowymi uprawami komercyjnymi: przykład rejonu Xishuangbanna w Chinach

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Abstract
On a global basis, cash cropping is usually identified as an important enterprise undertaken by farmers to increase incomes. However, the responses of farmers to these new enterprises vary greatly. Through a case study of a Dai village in Xishuangbanna, China, this paper examines how farmers make decisions about adopting new cash crops by focusing on the farm economy and land conditions. The results show that farmers did not adopt watermelons due to poor irrigation and accessibility conditions, and then they did not adopt bananas due to a transient collapse of banana market, induced by a rumor suggesting that eating bananas causes cancer. Consequently, although these non-adopters benefited from commercial exchanges with external businessmen in terms of ecological experiments and management diversification, and leasing lowlands to external businessmen is a livelihood choice that is based on the outcome of the farmer's trade-off between profitability and risk, they missed opportunities to substantially increase incomes through cash cropping, as evidenced by the success of the farmers who adopted the cash crops. These findings suggest that the government ought to design tailored extension programs for villages, implement efficient refutation strategies to prevent rumor-induced market collapse and promote extension services as early as possible in the initial stages of transition to cash cropping.

Key words: land use, crop choice, livelihood transition, tropical agriculture, farmland leasing

Streszczenie
Patrząc z perspektywy globalnej za uprawy komercyjne uznaje się istotne działania podejmowane przez rolników w celu zwiększenia swoich dochodów. Jednakże zainteresowanie rolników nowymi rozwiązaniami jest bardzo zróżnicowane. Niniejszy artykuł na przykładzie doliny Dai w należącym do Chin rejonie Xishuangbanna pokazuje jakie czynniki finansowe i środowiskowe wpływają na podjęcie przez rolników decyzji odnoszących się do nowych upraw komercyjnych. Otrzymane wyniki pokazują, że za odrzuceniem arbuzów stały ograniczone możliwości nawadniania i ograniczony dostęp, a za odrzuceniem bananów chwilowe załamanie rynku zbytu tych owoców, związane z szerzącą się pogłoską, jakoby konsumpcja bananów mogło być przyczyną nowotworów.Konsekwentnie, chociaż rolnicy odrzucający nowe uprawy korzystali z wymiany handlowej z zewnętrznymi przedsiębiorcami pod kątem eksperymentów ekologicznych i dywersyfikacji zarządzania, a ponadto biorąc pod uwagę, że przeznaczanie pól dla zewnętrznych przedsiębiorców jest decyzją opartą na ocenie możliwych zysków i strat, ci rolnicy

stracili szansę na znaczące zwiększenie przychodów z upraw komercyjnych. Pokazuje to przykład rolników, którzy jednak zdecydowali się na nowe uprawy. Uzyskane rezultatu wskazują, że rząd powinien przygotować dostosowane do potrzeb rolników programy i strategie odnoszące się do tych zagadnień.

Słowa kluczowe: zagospodarowanie terenu,wybór uprawy, przekwalifikowywanie, rolnictwo tropikalne, leasing pól uprawnych

1. Introduction

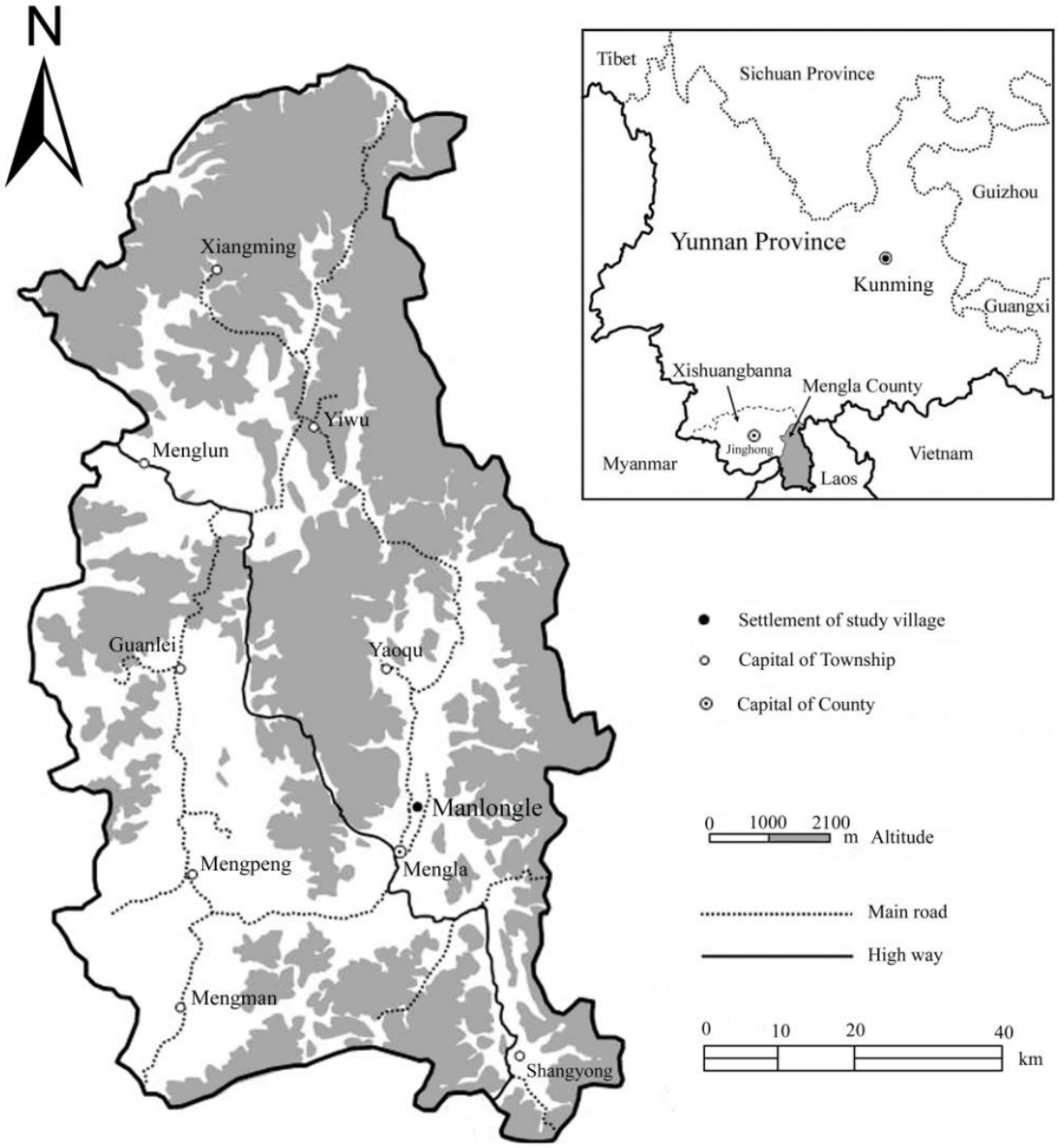
Adopting cash crop plantation, as one new agricultural practice, has become an expanding global phenomenon (Evans et al., 2011; Li and Fox, 2012;Klasen et al., 2013; Su et al., 2016; Vongvisouk et al., 2016), and cash cropping systems offer opportunities to increase farm incomes substantially (Hossain, 1998; Van den Berg et al., 2007). Focusing on the responses of farmers to these new enterprises, some empirical studies have found that smallholder farmers who can overcome barriers, either on their own or with support from outside their village, have achieved unprecedented wealth from growing new cash crops (Fox and Castella, 2013; Zhang et al., 2014). However, others have argued that a *safety first* principle often prevails for subsistence-oriented farmers (Rigg and Salamanca, 2009), and they hesitate to adopt new agricultural practices from the larger societies that have embraced them (Joseph and Richard, 2002). The reasons why these new practices are adopted by some socioeconomic groups but not others are multi-factorial, reflecting a complex combination of individual and environmental factors and events (Linquist et al., 2007; Rerkasem et al., 2002). Thus, Cramb (2000) emphasized that a detailed, *all things considered* case history approach is needed to understand the mechanisms behind the diffusion of agricultural innovations.

A number of studies have examined the factors influencing the adoptions decisions (Dercon, 1996;Seo and Mendelsohn, 2008; Ruf and Schroth, 2015;Lee, et al., 2016;). As past experiences show, constraints to the adopting new agricultural practices include insufficient human capital, lack of credit, inadequate farm size, limited access to technology and poor transportation infrastructure (Feder et al., 1985; Sheikh et al., 2003; Mazvimavi and Twomlow, 2009). Most importantly, the inaccessibility of marketing networks is an often-mentioned variable, which has been influential in determining the adoption of an agricultural innovation (Zeller et al., 1998). Rumors associating products with undesirable or even bizarre characteristics are threatening to sales, and have frequently resulted in sizeable losses for farmers (Tybout et al., 1981; Xu et al., 2013). However, few empirical studies have treated the spread of such rumors as a strong impediment to the adoption of new agricultural practices. There is general agreement in the literature that risk aversion is an important factor explaining the adoption behaviors of farmers towards new agricultural practices (Feder et al., 1985; Burger et al., 1993). Risk, interpreted as the uncertainty of outcomes, presents in all agricultural decisions as a result of price, yield and resource uncertainty (Hardaker, 2000; Lee, et al., 2016). Weir and Knight (2000) indicated that if a potential adopter faces uncertainty about the outcomes, there is an incentive not to adopt new practices. Moreover, the performance of pioneers who experiment with an innovation at the village level can deeply affect the behaviors of other farmers (Trung, 2002; Jiang et al., 2006). Farmland leasing is commonly considered a straightforward way to avoid agricultural risk (Quibria and Rashid, 1984). Studies of farmland leasing focus on the conditions under which leasing arrangements develop and the economic motivations of the parties (Boumtje et al., 2001). Many literatures have stated that the introduction of new cash cropping can enhance farmers' desire to manage farms (Zhang et al., 2014; Zhang et al., 2015), while low farming profits of subsistent crops push farmers into the off-farm sector and trigger farmland leasing (Jiang et al., 2013). However, cash cropping usually requires high and risky capital costs, and its expansion usually triggers wide spread farmland leasing in developing countries (Yang and Liang, 2008; Hall, 2011; Friis and Nielsen, 2016). Thus, a debate regarding incentives to engage in farmland leasing ensued and remains largely unresolved.

Xishuangbanna borders Laos and Myanmar and is an autonomous prefecture of the Dai people at the southern tip of Yunnan Province, China. This prefecture is separated from historically more advanced areas by numerous mountains and has often been considered a poor and backward area in China (Xu et al., 2005). The Dai ethnic group is in the majority and occupies almost all the lowland fields in Xishuangbanna. The development of China's economy has increased demand for tropical products and natural resources. In this context, Xishuangbanna, a tropical area of China, has been experiencing a rapid expansion of cash cropping (Guo et al., 2002; Li et al., 2007; Sturgeon, 2010; Fox et al., 2014; Xu et al., 2014).

This study focuses on lowland management in a Dai village, Xishuangbanna. Watermelon farming was initiated in this village in the early 1980s, and the growing of commercial banana crops was introduced in the late 2000s. However, farmers did not adopt these new enterprises. This paper examines the factors that led to the differentiation to adopt these new cash cropping systems by focusing on farm economy

Figure 1. Location of the study village in Xishuangbanna, China



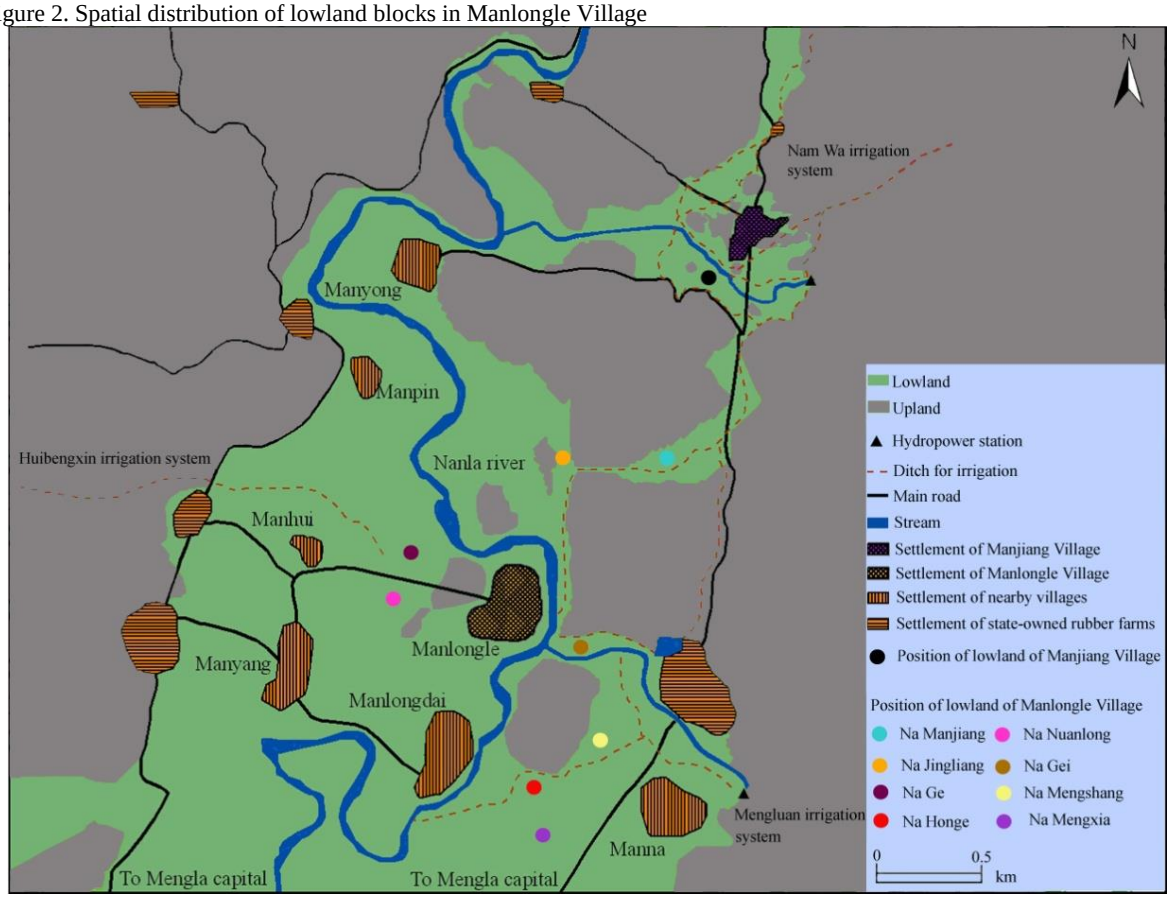
and land conditions. The objective of this study is to understand why these farmers do not adopt new cash crops. Specifically, the following questions were addressed: (a) how did the differences in the lowland systems of these villages influence the adoption of new cash cropping systems? (b) how did farmers make decisions involving the tradeoff between profitability and risk? and (c) how did institutional settings affect the adoption of new cash cropping systems? This study mainly aims to contribute to filling the knowledge gap concerning the crop choices at household and land plot level.

2. Materials and methods

2.1. Study village

The Manlongle Village is located in Mengla County, Xishuangbanna Dai Autonomous Prefecture, Yunnan Province, China (Fig. 1). This area has a tropical climate with an average annual temperature and precipitation of 22.5 °C and 1,420 mm, respectively. Manlongle was established in 1879 when nine households moved to this location from present-day Laos, and 76 Dai households have inhabited this village since 2001 (Zhang et al., 2015). The lowland fields in Manlongle are spatially dispersed, and some of the fields are separated from the residential area

Figure 2. Spatial distribution of lowland blocks in Manlongle Village



by long distances and/or a river. Therefore, it is not convenient for farmers to manage all of the lowland fields.

2.2. Data collection

Four rounds of field surveys were conducted in the study area in September-October 2010, January-February 2011, July-August 2011 and February-March 2012. In-depth interviews were conducted with all household heads, the present and former members of the village committee in Manlongle. The content of the household interview covers demographic (birth, death, health, age, education and marriage), land (size, quality, acquisition and leasing), agricultural system (land farming, forestry, livestock breeding, aquaculture, economic return and access to technology, labor, sales channels and credit), and off-farm system (workplace, work content, economic return and access to the acquisition of employment opportunities) information. All inputs and outputs, including any output retained for farmers' own consumption, were valued at market prices. After a prior investigation, we found that a farmer's assessment of whether he or she benefitted from adopting a new cash cropping system was based only on a comparison of the *real* inputs, such as cash, fertilizer, fuel and pesticide, relative to the outputs. Therefore, we did not consider labor as an input cost in this study.

3. Results

3.1. Lowland system of the study village

The lowland fields of Manlongle are divided into 8 blocks (Fig. 2). Two blocks, Na Nuanlong and Na Ge, are located close to the settlement and are irrigated by the Huibengxin irrigation system. The remaining six blocks are located on the opposite side of the Nanla River, of which Na Mengshang, Na Honge and Na Mengxia are irrigated by the Mengluan irrigation system; Na Jingliang and Na Manjiang are irrigated by the Nam Wa irrigation system; and Na Gei is located in the downstream region of the Nam Wa irrigation system and is fed by a pond. The irrigation of the three blocks irrigated by Nam Wa was classified as good as a result of the sufficient water supply. Meanwhile, the irrigation of the three blocks irrigated by Mengluan was classified as good or average, while that of Na Honge was classified as bad due to its poor drainage. Finally, the irrigation of the two blocks of Huibengxin was classified as average or bad because of insufficient water supply (Table 1).

The farmers acquired the lowland fields mainly through official allocation procedures. The Household Responsibility System was implemented in the study village at the end of 1982. Each farmer received 2.25 mu (1 ha is equivalent to 15 mu), and

Table 1. Attributes of the lowland blocks of Manlongle Village in the early 2000s (1 ha is equal to 15 mu)

Lowland blocks	Area (mu)	Field conditions				Land quality
		Road access	Irrigation		Drainage	
			Water availability in the dry season	Water quality		
Na Nuanlong	298.5	good	no	good	good	average or bad
Na Ge	39.0	good	no	good	poor	bad
Na Mengshang	79.5	good	yes	warm and slightly salty	good	good or average
Na Honge	25.5	good	yes	warm and slightly salty	poor	bad
Na Mengxia	184.5	good	yes	warm and slightly salty	good	good or average
Na Gei	16.5	good	yes	salty	good	good
Na Jingliang	45.0	poor	yes	good	good	good
Na Manjiang	147.0	good	yes	good	good	good
Total	835.5					

Note: we defined *field conditions* and *land quality in 1982* based on farmers' perception.

834 mu of lowland fields were allocated in total. Only 1.35 mu, accounting for 0.16 percent of the total lowland area, was claimed spontaneously by farmers and was not involved in the allocation process. The area of the lowland is approximately 10.5 mu per household and ranges from 0.18 to 19.5 mu. Only 4 households possess 6 mu or less of lowland, and 6 households possess at least 15 mu. The lowland-upland border at Manlongle has not changed since the early 1980s.

3.2. Adoption decision for watermelon farming

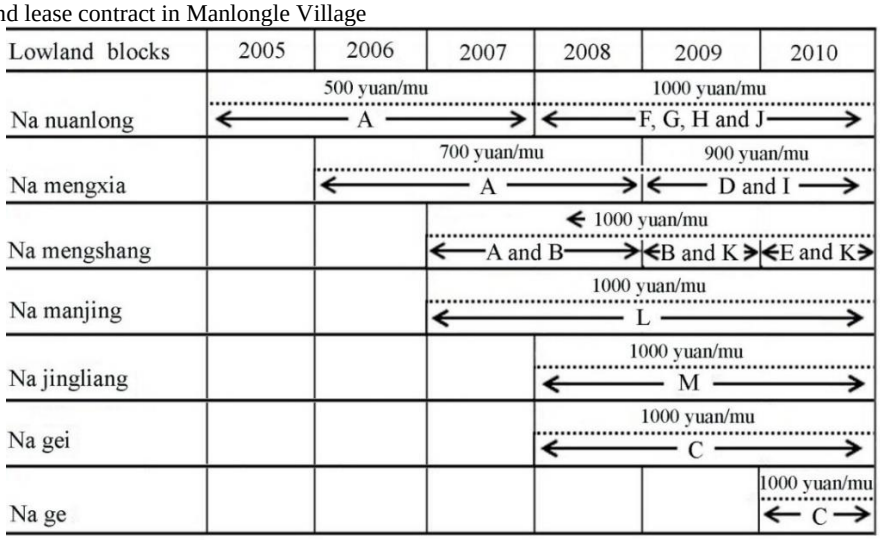
Under the collective farming system (from the mid-1950s to the early 1980s, when agrarian production in China was mainly managed by collective units, such as People's communes), most of the lowland fields were single-cropped with paddies in the rainy season. In 1982, the Administration of Agricultural Scientific Research of Mengla County set up a program to promote watermelon farming by providing seeds and instruction. The government also promised to purchase products after harvest at a price of 0.10-0.14 yuan/kg. The elder farmers of Manjiang village, a neighboring Village, reported that the watermelon yield was approximately 1500kg/mu. In contrast, the yield of farm-gate unhusked rice was approximately 200 kg/mu and its price was only 0.09 yuan/kg. Therefore, the return from growing watermelon could reach 4.2-5.8 times that of paddy farming. The farmers of Manlongle also received inaccurate information regarding inputs and returns. In this context, several farmers in Manlongle started growing watermelon at Na Nuanlong and Na Ge in 1983. Unfortunately, most of the watermelon seedlings died before reaching maturity because irrigation water was not available in the dry season. This discouraged the farmers in the other lowland blocks from growing watermelon because they perceived this crop to be high-risk.

In 1985, a Han businessman from Anhui Province rented land in Na Mengshang, Na Honge and Na Mengxia to grow watermelon, but more than one-third of the watermelon seedlings died before blossoming. The Han businessman told farmers that watermelon could not be grown in these blocks because the water of Mengluan was slightly salty and too warm due to its small runoff contribution and long-distance transportation. In 1986, a Manjiang villager rented land in Na Gei to grow watermelon but ultimately failed because the pond water was too salty. Although Na Jingliang and Na Manjiang had suitable water for growing watermelon, the conditions of the road from the settlement of Manlongle to these blocks was poor, and tractors could not access the fields. Hence, these farmers gave up growing watermelon and rented out Na Manjiang to Manjiang farmers in the dry season because of its good accessibility from Manjiang Village. The Manjiang farmers then grew watermelon in Na Manjing in the dry season.

3.3. Adoption decision for commercial banana farming

By 2004, all the households of Manlongle were engaged in paddy growing. In 2005, a Han businessman (Mr. A in Table 2) visited the village. He was a farmer in Sichuan Province before moving to the study area. This businessman first contacted the village headman and expressed his wish to rent lowland fields of Na Nuanlong for growing bananas. The headman coordinated the negotiation between the businessman and farmers and allowed all landhold-

Figure 3. Lowland lease contract in Manlongle Village



ers to reach a consensus with respect to renting out the whole block. All Na Nuanlong landholders agreed to rent out the fields for three years at a rate of 500 yuan/mu per year. The lease contract had a typical format, including the location of the land, the rental period, the rent, the responsibility of each side, and conflict resolution measures, and was signed and fingerprinted by the businessman, landholders and village headman.

After successful commercial banana growing in Na Nuanlong, Mr. A proposed expanding banana farming to Na Mengxia in 2006 and Na Mengshang in 2007 and offered higher rent, i.e., 700 yuan/mu in 2006 and 1,000 yuan/mu in 2007 (Fig. 3). The landholders accepted. In 2007, the staff of a nearby state-owned rubber farm (Mr. L in Table 2) rented Na Manjiang and started growing bananas. In 2008, Mr. A set up a new banana farm in another village, and his banana farm at Na Nuanlong was succeeded by several newcomers (Fig. 3).

Table 2.Attributes of banana businessmen in Manlongle Village

Name	Original location	Former occupation	Ethnicity
A	Sichuan	farmer	Han
B	Sichuan	retired staff	Han
C	Sichuan	farmer	Han
D	Sichuan	farmer	Han
E	Sichuan	farmer	Han
F	Guangdong	driver	Han
G	Guangdong	farmer	Han
H	Guangdong	farmer	Han
I	Guangdong	farmer	Han

Land suitability for banana growing differs slightly from that for paddy-based cropping. Na Honge was not rented out in 2010, against the wishes of the landholders. Na Ge was rented out, but only in 2010, later than the other blocks. These findings suggest that poor drainage was the major constraint for banana growing, whereas insufficient water supply in the dry season and poor water quality were not.

During the process, 13 businessmen rented lowland fields for banana growing, of which 12 businessmen were Han people. The sole Dai businessman (Mr. M in Table 2) was a farmer at a village close to the county capital and married a Manjiang woman.

Considering both profitability and risks, the Manlongle farmers chose to rent out their lowland fields rather than grow banana themselves. Economic incentives explain why farmers agreed to rent out their fields: the income from renting out lowland fields was higher than that from paddy-based farming in the previous year despite the omission of labor input from the cost of lowland farming (Table 3, Fig. 3). Furthermore, the famers did not need to concern themselves with production uncertainties or sale procedures. As a result, only 5 out of 76 households were engaged in double paddy cropping systems in 2010.

Inspired by the Han businessman (Mr. A in Table 2), the village headman bought hybrid banana seedlings, learned the techniques from Mr. A and grew 10 mu of bananas at Na Gei in 2006. However, the Chinese media reported banana Panama disease as *banana cancer* in 2007, fueling a rumor that eating bananas caused cancer, which in turn resulted in panic, a nationwide avoidance of banana consumption and price collapse. In 2007, the village headman failed to sell all his produce. When Mr. C proposed taking over the banana farm after the 2008 harvest, the village headman unhesitatingly accepted. This headman only earned approximately 300 yuan/mu per year by growing banana (as cited in the headman's note), which is much less than the return of paddy farming. Consequently, other farmers quickly abandoned the idea of growing bananas.

Table 3.Returns for traditional cropping patterns in the lowland blocks of Manlongle Village (unit: yuan/mu, parentheses indicate SE)

Lowland blocks	2004	2005	2006	2007	Traditional cropping pattern (before the introduction of banana farming)	
					Rainy season	Dry season
Na Nuanlong	475.5 (15.1)	-	-	-	paddy	maize
Na Mengxia	572.0 (7.7)	603.9 (8.2)	-		paddy	paddy
Na Mengshang	564.6 (10.5)	595.4 (11.0)	639.6 (12.0)	-	paddy	paddy
Na Manjiang	466.5 (2.0)	523.2 (2.0)	575.4 (2.0)	-	paddy	rented out
Na Jingliang	564.0 (13.8)	595.7 (14.8)	639.0 (15.8)	776.0 (19.3)	paddy	paddy
Na Gei	489.7 (24.5)	515.7 (26.4)	554.5 (29.4)	671.0 (33.8)	paddy	paddy
Na Ge	195.1 (16.9)	204.8 (18.0)	219.9 (19.1)	266.7 (22.7)	paddy	fallow
Na Honge	604.2 (7.73)	638.6 (10.0)	684.5 (7.7)	827.6 (8.2)	paddy	paddy

3. Discussion and conclusion

This study describes the introduction of government-promoted watermelon farming and market-initiated banana cropping into the study village. However, the study shows an apparent gap between incentives from cash crop and farmers' responses, which vary greatly. Manlongle farmers did not adopt watermelon farming in the early 1980s due to poor irrigation and accessibility conditions, and they also did not adopt banana farming in the late 2000s due to the collapse of banana market, induced by a rumor suggesting that eating bananas causes cancer. However, the expansion of banana cultivation rapidly changed the lowland cropping pattern of the study village, as observed in other parts of Xishuangbanna, to banana monoculture. Moreover, almost all banana farms were managed by external businessmen rather than Manlongle farmers.

In the early 1980s, the Household Responsibility System reallocated collective land to individuals and provided autonomy over decisions with respect to crop choice and land use (Krusekopf, 2002). Under this system, Chinese farmers were responsible for the losses of their enterprises. Moreover, the Chinese government initiated a transition from a planned economy to a market economy in the late 1970s, and this reform has facilitated the flow of people and goods between the production and consumption areas in all regions of China. Under this background, the external businessmen provided Manlongle farmers with the opportunity to serve as the landowners of watermelon farms to hedge the risk of the ecological experiments and to generate higher income without the risks of banana cultivation. Thus, the farmers benefited from interacting with these external businessmen.

The failure of the Manlongle headman to adopt banana farming was mainly the result of a rumor. Consequently, the idea of self-supporting banana farms was quickly abandoned, and they accepted their role as landowners. This rumor essentially originated from the limited science literacy of the public and the dangerous status of food safety in China. Cyert and March (1963) indicated that an understanding of reality is necessary before a rational decision can be made. In 2010, China Association for Science and Technology reported that only 3.27 percent of the total population of China had basic scientific literacy. Many people may not be able to identify these rumors as false. Furthermore, Chinese consumers lack confidence in food safety due to an increase in food poisoning incidents (Bai et al., 2007). Modern communication media, especially the internet and mobile phone text messages, can spread these rumors widely and rapidly, promoting panic. The experience in Manlongle is not an isolated phenomenon, and such rumors are increasingly common in China (Xu et al., 2013). Therefore, the government should design more efficient refutation strategies for preventing the rumor-induced collapse of the agricultural produce market.

Feder et al. (1985) indicated that adoption behaviors differ across socioeconomic groups and that immediate and uniform adoption behaviors are quite rare. Although the replacement of previous cropping patterns with banana cultivation across all village fields gives the impression of collective action under the instruction of the village authority, the change was undoubtedly the aggregate result of the decision processes of each household. It is also true that the decision-making processes of households within a village are interdependent in many ways. Zhang et al. (2015) noted that Dai village has interactive deci-

sion-making customs, and once a proposal receives support from most farmers, dissidents have to abide by this decision. Poor farm layouts might also constrain the independent crop selection of a household. A few farmers worried that banana cultivation might be harmful to their land, but once the cropping patterns of surrounding fields changed, these farmers had to follow suit due to the low density of farm roads and ditches.

This study suggests that irrigation conditions and land accessibility differentiate lowland use among villages in the study area. The daily life of Dai people is closely linked to water, which has contributed greatly to the development of traditional irrigation systems. However, the Lancang River and its tributaries do not irrigate most of the lowland fields. Consequently, most farmers in this area must rely on small streams adjacent to their villages, and access to water for irrigation frequently plays a key role in their livelihoods (Gao, 1999). Manjiang Village is located at the foot of high mountains, and river flow is available throughout the year. The lowland fields of this village feature good accessibility and irrigation conditions (Fig. 2). This village successfully adopted watermelon farming in the early 1980s and refused to rent their land to Han businessmen because the return from a double cropping system (paddy and watermelon) was 1.7-3.2 times the rent offered during 2005-2007. After three years, many banana farms were established by external businessmen in neighboring villages, and local farmers became familiar with this new enterprise. In 2008, the Manjiang farmers initiated banana farming and were successful (Zhang et al., 2014). In 2010, the household income of Manjiang Village was 2.2 times higher, on average, than that of Manlongle due to varying lowland management practices.

The failure in adopting watermelon farming demonstrates that the government ought to consider contextual conditions, which may vary from village to village, and promote tailored extension programs for each village. On the other hand, Manlongle was the first village to introduce banana farming to its neighbors, and all local farmers and commercial agents lacked experience in banana farm management. Although the local government dispatched staff to the study village to teach farming techniques each year, they did not teach banana farming techniques until 2011. Dai farmers commonly lack social connections to Han businessmen and cannot obtain assistance from them. In this context, banana growing is a high-risk choice, and farmers' perceptions of this enterprise as high-risk were enhanced by the headman's failure, induced by a rumor suggesting that eating bananas causes cancer. Thus, the government should implement efficient refutation strategies to prevent rumor-induced market collapse and provide extension services as early as possible in the initial stages of transition to cash cropping.

Acknowledgments

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