Research article

Assessment of Farmer's Satisfaction and Preference Using Improved Rice Varieties in the Southern Lao PDR

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Abstract Since 1993, more than 21 improved rice varieties have been released to Lao farmers. However, there is no study conducted yet on farmer's satisfaction on the use of improved rice varieties. Hence, the purposes of this study were to 1) evaluate the level of farmer's satisfaction on using improved rice varieties; and 2) farmer's preferences on rice characteristics. Purposive and simple random samplings were used to select the samples. Intervals mean score was used to measure the level of farmer's satisfaction. The target population was farmers who have grown rice under irrigated and rainfed conditions in the lowland areas. A total of 118 farming households in the rice producing areas of Savannakhet and Champasak provinces were surveyed through structured questionnaires from March to April 2011. The study found that all rice grown under irrigation were improved varieties. In rain-fed condition, about 96% were improved varieties and about 4% were traditional varieties. The average rice yield in irrigated areas was higher than in rainfed conditions. Popular improved rice varieties grown in the study areas were Phonengam 3 (PNG3), followed by Thasano 3 (TSN3) and Thadokkham 1 (TDK1). The level of farmer's satisfaction on using improved rice varieties ranged from high to highest level. However, the aroma characteristic was at a medium level. High yielding characteristic was the most preferred by farmers, followed by the grain size, early maturity, tolerance to drought, and resistance to pest and diseases.

Keywords: improved rice variety, satisfaction, preference, southern Lao PDR

INTRODUCTION

Agriculture is one of the most important sectors in Lao People's Democratic Republic (Lao PDR). The share of agriculture in economy accounted for 34.4 % of the Gross Domestic Product (GDP) and provided around three-quarters of the total workforce (Department of International Corporation, 2011). Rice is the main staple food of the Lao people and accounted for more than 903,501 ha (80%) of the total cropped areas with a total production of 3,102,368 tons, the average rice yield was 3.44 t ha^{-1} (Department of Planning, 2009). The rice production systems in Lao PDR can be classified into three broad ecosystems: irrigated lowland, rain-fed lowland and upland. Irrigated and rain-fed lowland are mainly located in central and southern regions. Savannakhet and Champasak provinces are the main rice growing areas in southern region. In 1990, about 95 % of rice grown in the lowland were traditional varieties with average yield of 2.32 t ha^{-1} (Linquist et al., 2006). To achieve self sufficiency at the national level the Lao-International Rice Research Institute (Lao-IRRI) project was set up in 1990 to increase rice production in the country (Shrestha et al., 2006). The main purposes of this project were the following: 1) to develop improved rice varieties or modern rice varieties (MVs) for lowland areas in the Mekong River Valley; and 2) to supply Lao farmers with varieties with high yield potential, resistance to the major pests and diseases, and broad adaptability to Lao condition (Schiller et al., 2000). Since 1993, more than 21 MVs were released such as Thadokkham (TDK1 to TDK11), Phonengam (PNG1 to PNG6),

Thasano (TSN1 to TSN5) and Namtanne (NTN1) (Inthapanya et al., 2006; Bounphanousay, 2010). Most of these varieties were glutinous rice varieties, photoperiod non-sensitive, high yielding and fertilizer-N responsive, resistant to plant diseases such as brown plant hopper (BPH), good milling and eating quality. Since the release of MVs to farmers in 1993, no study was conducted so far to assess farmer's satisfaction level with improved rice varieties in the country. This information is vital to guide rice breeders and extension workers to facilitate wider acceptance of further released varieties. Furthermore, the information on farmer's preference to rice characteristics is also essential for the rice breeders to know the characteristics farmers need. This study aimed to evaluate the level of farmer's satisfaction on using MVs and farmer's preferences to rice characteristics.

METHODOLOGY

A purposive sampling technique was used to select the representative areas. In consultation with the National Rice Research Program (NRRP), the study areas were selected from the two largest rice growing provinces (Savannakhet and Champasak) in the southern parts of Lao PDR. District with both irrigated and rain-fed rice production where the farmers had experiences in growing MVs were selected. Face to face interviews with household heads were conducted using structured questionnaires in 4 villages: Kor and Phaleng in Champhone district, Savannakhet province, and Nakham and Tomoh in Pathoumpone district, Champasak province. Sample size was calculated using the Taro Yamane formula (Yamane, 1960). Out of 191 households, 118 were randomly selected using simple random sampling technique. The questionnaire was pre-tested before the actual survey.

Farmer's satisfaction level was evaluated using a rating scale from 1-5, with 5 for the highest satisfaction level, and 1 for the lowest satisfaction level (Table 1). Farmers were asked to select the improved rice variety most planted in their rice fields. Farmers were then invited to express their satisfaction level base on seed, agronomic, postharvest, cooking and eating quality characteristics of the their selected varieties (Table 3). To determine what rice characteristics were most preferred, a set of photographs were shown to farmers, and allowed them to select the image they most preferred, and asked the reasons of their choice.

Statistical Package for Social Science (SPSS) software program was used for data analysis. The analysis included frequency, mean, percentages and t-test. Farmer's satisfaction levels were determined using interval mean scores, dividing into five interval levels (Chantrasouvan, 2002). The intervals mean score (Table 1) was calculated using Eq. (1) below. For example, using highest score of 5, lowest score of 1, and number of interval levels of 5, the resulting interval mean score was 0.08. Using Eq. (2), the highest point of the first level was 1.79.

$$\text{The highest point of the first level} = \text{The lowest score} + \text{interval score} - 0.01 \quad (1)$$

$$\text{Interval score} = \frac{\text{Highest score} - \text{Lowest score}}{\text{Number of interval level}} \quad (2)$$

The calculation of interval mean scores shown as follows:

$$\text{Interval score} = \frac{5-1}{5} = 0.08 \quad (3)$$

Table 1 Measurement of the satisfaction levels

Description	Rating score	Range
Highest satisfaction	5	4.20 – 5.00
High satisfaction	4	3.40 – 4.19
Medium satisfaction	3	2.60 – 3.39
Low satisfaction	2	1.80 – 2.59
Lowest satisfaction	1	1.00 – 1.79

Source: Chantrasouvan (2002)

RESULTS AND DISCUSSION

Rice varieties used in Southern Lao PDR

Results of the household survey showed that 100% of the rice varieties grown in dry season (irrigated) were MVs. About 96.0% of the varieties grown in wet season (rainfed) were MVs while only 4.0% were TVs. PNG3 was the variety most grown in the study areas which accounted for 21.6% in dry season and 15.9% in the wet season (Table 2). Other MVs widely grown in the study areas were TSN3 and PNG6. PNG3, a high yielding and photoperiod non-sensitive glutinous rice variety, has good eating and milling qualities and suitable to drought prone areas such as in central and southern regions of Lao PDR. However, this variety is susceptible to low temperature, and to some pests and diseases such as bacterial leaf blight, gall midge and brown phanthopper. The MVs commonly grown by farmers included TDK4, TDK5, TDK6, TDK7, TDK11, PNG5, PNG6, TSN1, TSN2, TSN4, TSN5, TSN7, RD6, and RD10, while TVs grown were Khao-teay, E-pa, E-teay, La-nard, E-dengnoi and Damdane. About 95% of the rice varieties grown were glutinous rice, and only 5% were non-glutinous rice (i.e Homsavan, KDML 105 and CR 103).

Table 2 Popular rice varieties and percent of each variety planted in the study area during dry and wet season

Name of Rice varieties	% of rice varieties planted under irrigated condition	% of rice varieties planted under rain-fed condition
Phonengam 3 (PNG3)	21.6	15.9
Thasano 3 (TSN3)	19.7	7.0
Thadokkham 1 (TDK1)	12.7	11.4
Phonengam 6 (PNG6)	11.9	10.0
RD10	8.2	5.5
Thadokkham 7 (TDK7)	6.0	5.0
Thadokkham 4 (TDK4)	0.0	9.5
Phonengam 5 (PNG5)	4.5	4.0
Thadokkham 5 (TDK5)	3.7	2.2
Other rice varieties	11.7	29.5
Total	100.0	100.0

The average yield of MVs in dry season (irrigated) was 3.08 t ha^{-1} and about 2.74 t ha^{-1} in wet season (rain-fed). The average yield of TVs was about 2.26 t ha^{-1} (only in wet season). TDK8 had the highest yield (3.63 t ha^{-1}) under irrigated condition (dry season), while TSN3 was the highest yield (3.39 t ha^{-1}) under rainfed condition (wet season). Average rice yield under irrigated condition was higher than that under rainfed condition. This is mainly attributed by good solar radiation during dry season which is essential for good photosynthetic activities of the rice plant. Farmers under irrigated areas (dry season) generally used higher chemical fertilizer input than in rainfed areas. Moreover, farmers with access to irrigation water also had better control and thus less risk to droughts and weed problem. In the wet season, flooding is a common problem of rice farmers. Based from the survey, farmers also indicated the importance of avoiding prolong use of same varieties in the same field. According to them, changing varieties regularly would increase rice yield and avoid incidence of pests and diseases. Sources of MVs seed were the following: 1) rice research center (Thasano Rice Research Center in Savannakhet province, and Phonengam Rice Research Station in Champasak), 2) exchange with neighboring farmers, 3) support from District Agriculture and Forestry Office (DAFO) and 4) Rice Productivity Improvement Project or RPIP.

Farmer's satisfaction using improved rice varieties

This study measured the farmer's satisfaction level on MVs based on: seed, agronomic, post-harvest characteristic, and eating and cooking quality. Results found that farmer's satisfaction was generally high and the highest level based on the characteristics evaluated by farmers (Table 3). With respect to seed characteristics, seed germination ability of MVs was at the highest satisfaction

level. According to farmers, the time needed to germinate seeds was shorter (soaking period of MVs took only 24 hours while the TVs took 48 hours), and percentage germination was higher compared to TVs. In terms of agronomic characteristics, the seedling growth rate of MVs was at the highest satisfaction level, MVs seedlings can be transplanted at a younger age (about 20 days old) compared to TVs (about 30 days old).

Farmers were also extremely satisfied (highest satisfaction level) with harvesting, yield and milling qualities of MVs. Farmers perceived that yields of MVs were higher than TVs because of their superior number of panicles per hill and grains per panicle. Due to their uniform plant height, the harvesting operations of MVs were easier than TVs. MVs was also perceived as lodging resistant especially during wet season when lodging can cause severe loss of production. In term of milling quality, farmers reported that polished grains from MVs were more appealing to them because they were whiter and lower percentage broken rice. Cooking (softness) and eating qualities of MVs were also mainly at highest level. However, the aroma of cooked rice was at a moderate satisfaction level only. TVs have better aroma than MVs. Since most rice produced by farmers is mostly for home consumption, softness (when cooked), whiteness and aroma were very important for farmers. Cooking and eating qualities are affected by grain amylase content (Shiller et al., 2006). Sall et al. (2000) indicated that amylose content is the most important chemical characteristic and determines the hardness of cooked rice. After cooking, rice grain with intermediate amylase content will produce "soft" cooked rice, while those with high amylase content will produce "hard" cooked rice. The majority of respondents were satisfied in PNG3 rice variety due to its agronomic characteristics (high yield, long panicles, uniform plant height), good for eating (soft and tasty) and milling quality (less broken rice and white polished grain).

Table 3 Percent frequency distribution of farmers according to satisfaction levels, and mean value of satisfaction levels with improved rice varieties

Characteristics of improved rice variety	Satisfaction level					Mean (n=118)	S.D (±)	Meaning
	Highest (5)	High (4)	Medium (3)	Low (2)	Lowest (1)			
I.Seed characteristic								
Grain shape and size	36.5	40.7	18.6	4.2	0.0	4.09	0.84	High
Seed germination	50.0	39.8	10.2	0.0	0.0	4.40	0.66	Highest
II.Agronomic characteristic								
Growing	33.9	52.5	12.7	0.8	0.0	4.19	0.68	High
Seedling growing	39.8	50.8	8.5	0.8	0.0	4.30	0.65	Highest
Tillering ability	37.3	44.9	16.9	0.8	0.0	4.19	0.74	High
Leaf structure	16.1	57.6	22.0	4.2	0.0	3.86	0.73	High
Panicle	30.5	46.6	19.5	3.4	0.0	4.04	0.80	High
Plant height	20.3	55.1	22.9	1.7	0.0	3.94	0.70	High
Pest resistance	14.4	48.3	28.8	7.6	0.8	3.68	0.84	High
Disease resistance	10.2	46.6	35.6	7.6	0.0	3.59	0.77	High
Lodging resistance	25.6	53.0	18.8	1.7	0.9	4.01	0.77	High
Maturity	25.4	54.2	20.3	0.0	0.0	4.05	0.67	High
III. Post harvest								
Harvesting	67.8	24.6	6.8	0.8	0.0	4.59	0.65	Highest
Grain weight	39.0	44.9	11.9	2.5	1.7	4.17	0.86	High
Yield	44.1	39.8	11.0	5.1	0.0	4.23	0.84	Highest
Milled rice	45.8	43.2	9.3	1.7	0.0	4.33	0.71	Highest
IV. Cooking and eating quality								
Softness	50.8	39.8	9.3	0.0	0.0	4.42	0.65	Highest
Eating quality	50.0	40.7	6.8	2.5	0.0	4.38	0.7	Highest
Aroma	14.4	27.1	42.5	14.4	2.5	3.36	0.98	Moderate
Overall Satisfaction	34.3	44.75	17.49	3.15	0.31	4.10	0.75	High

Satisfaction levels of male and female farmers on using MVs were also compared. Among the characteristics considered, only those in harvesting were significantly different. Based on the mean score of harvesting difference, the satisfaction level of the female group was higher than the male group because the harvesting activities were carried out mainly by the female group. According to female interviewees, MVs had uniform plant height, thus facilitating harvesting. The p-value of satisfaction between male and female farmers on MVs in term of seed characteristic, agronomic characteristic, grain weight, milled rice, cooking and eating quality are statistically not significant. The mean score between the two groups were also not significantly different.

Farmers' preference on rice characteristics for future improvement

The results of farmer's preference are presented in Table 4. Varieties with high yielding characteristics were the most preferred by farmers for they assure an abundant harvest for family consumption, and extra income to support household expenditure. Big and long grains were also preferred as farmers perceived that these were indicators of good grain quality. The third preference was early maturity characteristic of the variety. Some farmers grew more than one rice variety in their rice field, but the lack of manual labor at peak of harvesting season was one of the predicaments of the farmers in the study areas. So, planting a number of early maturing varieties would facilitate better scheduling of labor during harvesting season. Farmers could harvest first the short duration (early maturity) varieties, then medium and late duration varieties. In addition, some households usually used up their rice stock in the storages before the peak of harvesting season, so the short duration varieties were very important for them. The fourth preference was the drought resistant characteristic of the variety. As farmers are also facing global warming effects, which have caused uneven and uncertain distribution of rainfall, planting drought resistant varieties were needed especially in rainfed conditions. The fifth preference was on resistance to pests and disease. According to farmers, a number of MVs are susceptible to pests and diseases, and therefore MVs to be introduced in their areas should be resistant. The preferences and perceptions expressed by farmers were similar to that of Manzanilla et al. (2011).

The study found that lack of water was the main problem for irrigated condition. Farmers indicated that the water from irrigation system was not enough after transplanting due to inefficient water delivery and unmaintained irrigation facilities and thus caused significant yield loss. In the wet season, pests and diseases problems such as rice bug, thrip, stem borer, gall midge, and grasshopper were the main concerns.

Table 4 Farmer's preference on rice characteristics

Characteristic of rice varieties	Score of farmers' preference *					Total score	Rank
	First	Second	Third	Fourth	Fifth		
High yielding	345	96	30	12	7	490	**1**
Good quality of grain	65	120	69	30	14	298	**2**
Softness	15	48	45	16	16	140	6
Need less fertilizer	25	12	24	24	6	91	8
Early maturity	30	52	66	22	9	179	**3**
Resistance to drought	45	44	42	30	11	172	**4**
Tolerant to flood	15	4	0	8	6	33	10
Resistance to pests and diseases	20	56	30	36	16	158	**5**
Resistance to lodging	15	24	27	42	21	129	7
High price	15	16	12	12	7	62	9
Can grow in DS and WS	0	0	9	4	5	18	11

*Note: * Score for each preference: for first preference multiply total frequency by 5; for second multiply by 4; for third multiply by 3; for fourth multiply by 2, and for fifth multiply by 1*

CONCLUSION AND RECOMMENDATION

This study concluded that the majority of farmers in southern region of Lao PDR have adopted improved rice varieties. The most popular rice varieties were namely PNG3, followed by TSN3, TDK1 and PNG6. The average rice yield in irrigated area (dry season) was higher than rainfed area (wet season). The farmer's satisfaction levels using MVs were mainly high and the highest levels. Characteristics with the highest satisfaction levels included seed germination, seedling growing, harvesting, yield, milled rice characteristics, and eating quality. The level of farmer's satisfaction for aroma characteristic was at moderate level as traditional varieties have better aroma compared to improved varieties. This means that rice breeders should enhance the aromatic smell of the improved varieties to facilitate higher satisfaction level from farmers. The farmer's preference on rice characteristic indicated that high yielding potential was most preferred by farmers, followed by size and shape of rice grain, early maturity, resistance to biotic (pests and diseases) and abiotic (drought, flooding, lodging) stresses. Rice breeders need to consider these characteristics in their rice breeding program to facilitate wider acceptance of improved varieties.

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