FARMERS' FEEDBACK ON RICE VARIETIES TESTED UNDER FARMER - MANAGED TRIALS

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ABSTRACT

The rice varieties planted by farmers in recent years (2012 and 2013) and before possess several positive agronomic traits and marketability. These varieties adapt well in farmers' localities. Male and female farmers expected that the new rice varieties can adapt well in their localities when the climate changes. The rice varieties should be tolerant to increased severity of flood/submergence, salinity, sulphate acid soil, insect pests and diseases caused by climate change. The new rice varieties developed by plant breeders were tested under farmer managed trials. Farmers feed back that OM 8108 and OM 4488 are tolerant to both salinity and submergence but need to improve the aroma, milling recovery and yield before disseminating to the flood prone and saline prone areas. OM 6677 is tolerant to both salinity and submergence but needs to improve the lodging status and incorporate both genes for saline and submergence tolerance. OM 7347 is suitable for flood prone areas but needs to incorporate the gene for submergence tolerance in this variety. OM 10252 and TLR 378, OM 7L, OM 90L are not ready for dissemination and need more improvement. The breeders, extension agents and local managers need to increase the numbers of male and female farmers testing the new technologies in order to improve characteristics suitable to their locality and adaptive under climate change.

INTRODUCTION

Submergence/flood is a serious problem affecting rice production in flood prone areas worldwide. In addition, climate change is further aggravating flooding risks of rainfed lowland rice areas, especially in areas affected by the monsoon rains. Submergence can be caused by river overflows, excessive rain and/or tidal inundation (Sairam *et al.*, 2008). Due to climate change, the intrusion of salinity in the coastal area in the Mekong delta is becoming more and more severe in recent years, particularly in the years with prolonged drought period and lower supply of fresh water flow from the upstream Mekong river. Rice production in submergence/flood and salinity prone areas is becoming more difficult. The main constraints to farmers' ability to adapt to the new hydrological regime are availability of suitable cultivars, limited soil nutrient management options, insufficient knowledge of potential harm from acid sulphate soil, inundation and planning tools. Thus, under the project "Climate change affecting land use in the Mekong Delta: Adaptation of rice-based cropping systems", new varieties which are tolerant to submergence and salinity were tested through participatory varietal selection (PVS). PVS includes researcher-managed and farmer-managed trials. In the researcher-managed trials, a set of lines/varieties which are identified by breeders as suitable for submergence and salinity were included. Men and women farmers were invited to vote/select for the two best lines/varieties based on visual ratings before the harvest season. In the farmer-managed trials, volunteer farmers tested the selected lines/varieties on their fields using their level of management (Paris *et al.*, 2011). They also had the opportunity to evaluate the post-harvest, cooking and eating quality of the test varieties

and compare them with the varieties they had been growing. PVS in the past has included only male farmers due to the perception that women are mere farm helpers despite the fact that they contribute their labor inputs in rice production (Chi *et al.*, 1994, Paris and Chi, 2005). Exclusion of women farmers in the research design, participatory experiments, evaluation and impact assessment leads to ineffective dissemination of technologies and failure to tap women's potential in ensuring household food security. Therefore, the objective of the paper is to elicit men and women farmers' feedback on the performance of new submergence/salinity tolerant rice varieties and acceptability for wider adoption.

MATERIALS AND METHODS

The research sites are located in the Mekong Delta, South Vietnam. The sites represent semi-flooded (Truong Xuan A and Thoi Tan communes of Can Tho city, and Vi Dong commune in Hau Giang) and salinity areas (Phuoc Long and Minh Dieu commune in Bac Lieu province). The farmer-managed trails were conducted in Wet Season (Summer-Autumn 2013 and Summer-Autumn 2014).

The seeds of test varieties which were produced by the breeders of Cuu Long Delta Rice Research Institute (CLRRI) were given to the farmer volunteers. Farmers planted the new rice varieties on their fields and managed by themselves. The socioeconomics research team from CLRRI visited and interviewed the volunteer farmers. Yields and other characteristics of the test varieties were compared with farmers' varieties.

RESULTS AND DISCUSSION

Land type where the farmer –managed trials were conducted

Farmers are quite aware that the position (low, medium and high) of their plots in the different flooded and salinity areas can affect rice cultivation. Actually, the differences between these fields by land type and soil type are based on farmers' experience. In each ecological zone, the differences in elevation among low, medium and high fields are small. A high field is considered 10 cm above some middle point, while low fields are 10 cm below the midpoint. This is an important consideration when flood occurs; higher fields are less prone to floods and are less likely to remain submerged for a long period of time.

A higher percentages of the farms in moderate flood area than in salinity area are located in relatively lower fields. Thus, they are easily submerged during flood, high tide and rainy periods. More than half of the rice fields in the salinity area are medium level land (Table 1).

Rice yields

The rice yields of the varieties planted by farmers in the wet season 2012 and 2013 were recorded to compare the performance of the test varieties and farmers' varieties. If the test varieties are better than farmers' varieties then test varieties will likely be adopted. In wet season 2012, farmers in moderate flood with alluvial soil planted IR50404 and OM 4218 with a mean yield of 5.6 t/ha. In moderate flood with acid soil, farmers planted IR50404, OM 4218, OM 5451, and OM 6976 with a mean yield of 5.9 t/ha. In salinity area, farmers in triple rice system planted several varieties as IR50404, OM 1490, OM 2517, OM 4218, OM 4900 and OM 6976 and the rice yield varied from 5.3- 5.8 t/ha. In the shrimp –rice system farmers planted Mot Bui Do with rice yield 5.0 t/ha and F Lai with yield of 6.5 t/ha.

In wet season 2013, farmers in moderate flood areas planted same the rice varieties as in wet season 2012 and obtained similar yields. In salinity area with triple rice, farmers almost planted same rice varieties and similar yield as in wet season 2012 and 2013, with the exception of an additional variety OM 7347, and the yield of that variety is not higher than other varieties. In the shrimp –rice system farmers planted Mot Bui Do with yield of 4.7 t/ha and F Lai with 6.5 t/ha as in wet season 2012. However, the observation in the site shows that the area planted with F Lai in 2013 was higher than in 2012.

Table 1. Farm information

Land type of rice parcel	Moderate flood with alluvial soil		Moderate flood with acid soil		Salinity	
	No.	%	No.	%	No.	%
Relative lower than medium level land *(dat trung in Vietnamese)*	12	50	9	38	10	31
Medium level land *(dat bang in Vietnamese)*	10	42	12	50	19	59
Relatively higher medium level land *(dat go in Vietnamese)*	2	8	3	13	3	9
Total	24	100	24	100	32	100

Positive and negative traits of the varieties grown under submergence area

During the wet seasons of 2012 and 2013, farmers planted several varieties under different submergence prone environments. Based on farmers' experience, the variety IR50404 showed the best performance and had several positive traits. IR50404 has the following positive traits: acceptable tillering capacity, early maturity, fits into the cropping systems, requires less inputs (irrigation, fertilizer, seeds) and labor. It is easy to harvest and thresh due to short stalks, high rate of headrice (more intact milled rice) after milling, less broken rice after milling. In terms of cooking and eating qualities, IR50404 gives a feeling of satiety after eating rice, good volume expansion ability. The grain yield is high and accepted by farmers (more than 5.0 t/ha). The seeds of this variety are also easy to buy at an affordable price, However, the undesirable traits of this variety are: remains hard when served as left over rice, creamish white grain (chalky and not much transparent and not preferred by consumers) and prone to lodging and submergence.

OM 4218 showed the following positive traits: fast growing seedling, intermediate plant height (90-100 cm), tolerance to submergence and lodging, early maturity, fits into cropping pattern. It requires less irrigation and seeds. The post-harvest qualities are: easy to harvest and thresh, has long and slender white grains, high rate of headrice grain, remains soft when served as leftover rice, has volume expansion ability, good grain yield and easy to market. Seeds of this variety are also easy to access. However, this variety has negative traits such as: susceptible to insect pest and does not have good aroma when cooking.

Similarly, OM 5451 variety has positive traits which farmers like. These are: high tillering ability, tolerant to submergence and lodging, fit into the cropping system, requires less irrigation, easy to harvest and thresh, white grain, high headrice recovery, long and slender grain, remains soft when served as left over rice and aroma. This variety is easy to sell. Seeds of this variety are easy to buy at an affordable price. However, this variety has the following negative traits: susceptible to insect pest, requires more inputs (fertilizer, seeds and labor); does not give a feeling of satiety after eating.

OM 6976 variety was perceived having positive traits as easily accessing seed at right time /right variety and right amount at affordable price, long and slender grains, fast growing seedling in salinity (as positive trait) but normal growing seedling in moderate flood area (as negative trait), tolerance to submergence, lodging and insect pests, fits into the cropping system, requires less inputs (irrigation, fertilizer and labor), easy to harvest and thresh, has white grains, volume expansion ability, good grain yield and easy to sell in market. It has negative traits as medium tillering ability, requires higher seed rates and does not give a feeling of satiety after eating.

Farmers mentioning "tolerance to submergence" of a rice variety explained that the rice plant can produce tillers even if the water level rose in the field during tillering stage. Farmers defined the

submergence condition as when the water level was below the plant height.

Positive and negative traits of the varieties grown under salinity area

In the salinity site, in wet season 2012 and 2013 the varieties OM 1490, OM 2517, and OM 4900 were also planted in the triple rice system. Farmers liked OM 4900 due to desirable agronomic traits such as: good grain yield, high seed germination growth, medium plant height (90-100 cm), short duration, fits into the cropping systems, requires less irrigation and fertilizer application. The post-harvest qualities which farmers liked are easy to harvest and thresh, high headrice grain, slender grains, gives a feeling of satiety in the stomach after eating, and marketability. The negative traits of this varieties perceived by farmers are: susceptible to insect and lodging, high seed and labor requirement, no aroma, remains hard when served as leftover rice, and low volume expansion ability when cooked. The seeds of this variety are easy to access at the right time at affordable price. OM 2517 has positive agronomic traits such as high germination rates, tolerance to submergence, short duration, fits into the cropping systems, requires less irrigation requirement, has high head rice recovery, good grain yield and marketability. It has negative traits such as: less lodging resistance and more labor requirement in crop care. Farmers also like OM 4900 because it requires less fertilizer, is easy to harvest and thresh, has white grains, high head rice recovery, long and slender grains, and remains soft when served as left over rice. The seeds are easy to access at affordable price. It has negative traits such as: susceptible to pests, diseases and lodging. It also requires higher seed rates.

Mot Bui Do and F Lai were planted in 2012 and 2013 in shrimp rice system. Farmers like Mot Bui Do because it has several positive traits as: tolerance to salinity, requires less fertilizer and labor for crop care. After cooking, it gives a feeling of satiety, it requires less cooking time, it has volume expansion ability and marketability. The seeds of this variety are easy to access at the right time and at an affordable price. This variety has long and slender grains. Traits of this variety which farmers find undesirable are: prone to lodging, has late maturity (115 -120 days), and requires more irrigation water (due to saline soils). The yields of this variety as not as high as expected. This variety does not have any aroma. Farmers easily access seed at right time, right variety, right amount at affordable price, slender grains.

F Lai variety was perceived that it possesses positive traits as easily accessing seed at right variety and right amount, long and slender grain, very fast growing seedling, good tillering ability (20-25 tillers/plant), medium plant height (90-100 cm), tolerance to pest/ diseases and lodging, medium maturity (96-105 days), fits the cropping pattern, less irrigation and labor requirement, easy to harvest and thresh, high rate of head rice after milling, tough grain, soft cooked rice (means remain soft when served as leftover rice), feeling of fullness in the stomach, less water requirement in cooking, less cooking time, remains soft when served as leftover rice, volume expansion ability, high grain yield and marketability. F Lai variety was perceived of possessing negative traits as not always accessing seeds at right time, very high seed price, no tolerance to submergence and high fertilizer requirement.

Regarding to farmers' perception on positive and negative traits of rice varieties planted before 2012, the varieties IR50404, OM 4218, OM 5451 possessed similar traits as when planted in recent years. In the salinity ecosystem with triple rice OM 2517, OM 1490, OM 4900 and OM 6976 planted before 2012 had similar traits as when planted in recent years. In salinity areas with shrimp-rice system, variety Mot Bui Do, and F Lai planted before 2012 was perceived possessing similar positive and negative traits as when planted in 2012 and 2013.

Submergence condition in farmer-managed trial

The plots used by farmers in testing the new varieties in the farmer-managed trials are prone

to submergence or floods. The water level rises are caused by high tide, long days and heavy rains. Floods occurred at the early stages of seedling and tillering stages in saline and flood prone areas. At the salinity areas, floods occurred with unexpected water level. The normal depth was from 5-10 cm at seedling and tillering stage, but when water rises the level was higher (> 30 cm) which causes seedling mortality and prevents tiller production. High water at panicle initiation and heading stages may also cause low rice yield due to prevention of flower development. High water level at harvesting stage is makes harvesting very difficult especially for women. The situation of high water level usually lasts for several days. In the farmer-managed trials in shrimp-rice system in Bac Lieu province, farmers were very much worried due to long days and heavy rains from the 2nd week September to the 3rd week of October. They were worried that they would lose their entire crop. Farmers had to pump out the water when high water level occurred.

The percentage of rice plant survival of tested varieties and farmers' existing varieties was high due to farmers' preventive measures such as pumping water out and replanting due to seedling damage.

Farmers' feedback of the tested rice variety under farmer-managed trials

Male and female farmers compared the tested varieties in farmer-managed trials with their existing varieties and found that OM 8108 was tolerant to both salinity and submergence in their locality, tolerant to pest and disease, and lodging. The overall performance in the field was better than their existing variety. Both male and female farmers observed that the rice yield of OM 8108 was better than their existing variety. However, its milling recovery was lower (Table 2).

Male and female farmers found that OM 4488 performed better than their existing variety in terms of tolerance to submergence and salinity, to pest and disease, and resistant to lodging. Its overall performance in the field was better than farmers' rice varieties. Its eating quality was better than farmers' rice variety. However, the grain yield and milling recovery were lower compared with farmers' rice varieties. Farmers compared OM 4488 with their varieties (IR50404, OM 4218 and OM 6932) (Table 2).

Table 2. Farmers' perception regarding to tested varieties OM 8108 and OM 4488

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
OM 8108 (tested at flood & saline prone)		**(n=9)**			**(n=6)**	
Tillering ability	33	11	56	33	33	33
Plant height		22	78		33	67
Tolerance to Submergence/salinity		44	56	17	17	67
Tolerance to insect		22	78		17	83
Tolerance to diseases	11	22	67		33	67
Lodging resistance		11	89	17		83
Overall performance	33		67	17		83

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	*Same as farmer's existing variety*	*Better than farmer's existing variety*	*Worse than farmer's existing variety*	*Same as farmer's existing variety*	*Better than farmer's existing variety*
Grain yield	33		56	33		67
Easy to harvest		89			100	
Easy to thresh		89			100	
Milling recovery	67		22	67		33
Market price		67	22		50	50
Cooking quality		44	44		83	17
Eating quality		33	56		50	50
Storage quality		67	22		50	50
OM 4488 (tested at flood & saline prone)		**(n=16)**			**(n=12)**	
Tillering ability	19	63	19	25	50	25
Plant height	19	25	56	8	17	75
Tolerance to Submergence/salinity	6	31	63		25	75
Tolerance to insect		44	56		25	75
Tolerance to diseases	6	19	75	8		92
Lodging resistance	13	19	69	17	25	58
Overall performance	25	6	69	25	17	58
Grain yield	56	13	31	50	17	42
Easy to harvest		88	12		100	
Easy to thresh		88	12		100	
Milling recovery	31	44	25	25	58	25
Market price	13	63	25		83	25
Cooking quality	6	44	50		58	50
Eating quality		13	88		8	100
Storage quality		81	19		67	42

The tested variety OM 10252 was compared with farmers' existing varieties (Mot Bui Do, F Lai and OM 5451). This variety was easy to harvest and thresh due to shorter stalk. The eating quality of this variety is better than the farmers' rice variety. However, its performance in terms of tolerance to salinity and submergence, pest and disease, and tillering capacity was not better than farmers' rice varieties. Its yield was lower than farmer' rice yield (Table 3).

Table 3. Farmers' perception regarding to tested varieties OM 10252

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
OM 10252 (tested at saline prone)		**(n=9)**			**(n=6)**	
Tillering ability	33	22	44	22	33	11
Plant height	33	11	56	44	11	11
Tolerance to Submergence/salinity	33	33	33	44		22
Tolerance to insect	33	22	44	44	11	11
Tolerance to diseases	33	33	33	44	11	11
Lodging resistance	22	22	56	11	22	33
Overall performance	22	33	44	33	22	11
Grain yield	56	11	33	56		11
Easy to harvest		22	78		11	56
Easy to thresh		11	89		11	56
Milling recovery	22	33	44	22	22	22
Market price		78	22		44	22
Cooking quality		56	44		56	11
Eating quality		11	89		11	56
Storage quality		78	22		56	11

The tested variety TLR 378 was compared with farmers' existing varieties (Mot Bui Do, F Lai and OM 5451). This variety was found to be tolerant to lodging. Its eating quality was better than farmers' existing varieties. It was easier to harvest and thresh because of its shorter stalks. However, its overall performance in the field was worse than farmer' existing varieties. Its tolerance to pest and disease was lower, grain yield and milling recovery were lower compared with farmers' varieties. It was not better than farmer' existing varieties in terms of tolerance to submergence and salinity (Table 4).

The test rice variety OM 7L in the flood prone area was better than farmers' existing varieties (IR50404 and OM 6932)regarding tolerance to submergence, pest, disease and lodging. Its overall performance in the field and eating quality was better than farmers' rice varieties. However, OM 7L showed lower tillering capacity and milling recovery compared with farmers' rice varieties. Moreover, its grain yield was lower than farmers' rice varieties (Table 4).

Table 4. Farmers' perception regarding to tested varieties TLR 378 and OM 7L

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
TLR 378 (tested at saline prone)		**(n=6)**			**(n=6)**	
Tillering ability	17	50	33	17	17	67
Plant height	33	17	50	50	50	
Tolerance to salinity	33	17	50	50	33	17
Tolerance to insect	50	17	33	67	17	17
Tolerance to diseases	50	17	33	67	17	17
Lodging resistance	17	17	67		17	83
Overall performance	33	17	50	50	33	17
Grain yield	67	17	17	67	17	17
Easy to harvest		17	83		17	83
Easy to thresh		17	83		17	83
Milling recovery	50	17	33	50	17	33
Market price	17	67	17	17	67	17
Cooking quality		83	17		83	17
Eating quality		17	83		17	83
Storage quality		83	17		83	17
OM 7L (tested at flood prone)		**(n=4)**		**(n=4)**		
Tillering ability	50	50		25	75	
Plant height		25	75		25	75
Tolerance to submergence		25	75		25	75
Tolerance to insect		25	75	25		75
Tolerance to diseases		25	75		25	75
Lodging resistance		50	50		50	50
Overall performance	25		75	25		75
Grain yield	50		50	75		25
Easy to harvest		100			100	
Easy to thresh		100			100	
Milling recovery	25	25	50	50	25	25
Market price	25	25	50		50	50
Cooking quality		25	75		75	25
Eating quality			100			100
Storage quality		25	75		25	75

Farmers found that OM 7347 was better than farmers' existing rice varieties (as IR50404 and OM 4218) in terms of tolerance to submergence, insect, disease, lodging and tillering ability. Its overall performance in the field was better than farmers' rice varieties. Its grain yield and eating quality were better than farmers' rice varieties. Its market price was same as farmers' rice varieties (Table 5).

Table 5. Farmers' perception regarding to tested varieties OM 7347

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
OM 7347 (tested at flood prone)		**(n=4)**			**(n=4)**	
Tillering ability			100			100
Plant height			100			100
Tolerance to submergence			100			100
Tolerance to insect			100			100
Tolerance to diseases			100			100
Lodging resistance		25	75		25	75
Overall performance			100			100
Grain yield	25	25	50	25	25	50
Easy to harvest		50	50		50	50
Easy to thresh		75	25		75	25
Milling recovery	25	25	50	25	50	25
Market price		75	25		75	25
Cooking quality		75	25	25	50	25
Eating quality		25	75		25	75
Storage quality		25	75		25	75

Can Tho 2 variety showed better tolerance to insect, disease and lodging than farmers' existing varieties namely IR50404 and OM 6976. Its overall performance in the field and eating quality were better than farmers' rice varieties. However, this variety had lower milling recovery compared with farmers' varieties (Table 6).

In salinity area, farmers found that OM 6677 is tolerant to submergence and salinity, to insect, and had high tillering ability. The grain yield, cooking and eating quality were better than farmers' existing rice varieties (as OM 6976 and OM 5451). Its overall performance in the field was better than farmers' varieties. However, farmer's existing rice varieties were more resistant to lodging than OM 6677 which has weak stems (Table 6).

OM 90L is better than farmers' rice variety in terms of tolerance to lodging, insects and

disease but not better than farmers' rice varieties with regards to tolerance to salinity ad submergence. Its yield is lower than farmers' rice variety (Table 7). OM 10041 is more tolerant to submergence, lodging, insect and disease than farmers' rice variety (Table 7).

Table 6. Farmers' perception regarding to tested varieties Can Tho 2 and OM 6677

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
Can Tho 2 (tested at flood prone)		**(n=4)**			**(n=4)**	
Tillering ability		50	50		25	75
Plant height		25	75		25	75
Tolerance to submergence		50	50		50	50
Tolerance to insect		25	75		50	50
Tolerance to diseases		25	75		25	75
Lodging resistance		25	75		75	25
Overall performance			100			100
Grain yield	25		75		25	75
Easy to harvest		50	50		75	25
Easy to thresh		50	50		50	50
Milling recovery	50	25	25	50	25	25
Market price	25	25	50	25	25	50
Cooking quality		100			50	50
Eating quality			100			100
Storage quality		75	25		75	25
OM 6677 (tested at saline prone)		**(n=3)**			**(n=2)**	
Tillering ability	33		67			100
Plant height	33	33	33	100		
Tolerance to Submergence/salinity		33	67		100	
Tolerance to insect		33	67		50	50
Tolerance to diseases		67	33		50	50
Lodging resistance	100			100		
Overall performance			100		50	50
Grain yield			100			100
Easy to harvest	67		33	50		50
Easy to thresh	67		33	50	50	
Milling recovery	33	33	33	50	50	
Market price		100			100	
Cooking quality		33	67		50	50
Eating quality		33	67		50	50
Storage quality	33	33	33	50		50

Table 7. Farmers' perception regarding to tested varieties OM 90 L and OM 10041

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	*Same as farmer's existing variety*	*Better than farmer's existing variety*	*Worse than farmer's existing variety*	*Same as farmer's existing variety*	*Better than farmer's existing variety*
OM 90 L (tested at saline prone)		**(n=2)**			**(n=1)**	
Tillering ability	50	50			100	
Plant height		100			100	
Tolerance to Submergence/salinity	50	50			100	
Tolerance to insect			100			100
Tolerance to diseases			100			100
Lodging resistance	50		50			100
Overall performance		50	50			100
Grain yield	50	50		100		
Easy to harvest	50	50			100	
Easy to thresh		100			100	
Milling recovery		50	50		100	
Market price		100			100	
Cooking quality		100			100	
Eating quality		50	50		100	
Storage quality		100			100	
OM 10041 (tested at flood prone)		**(n=2)**			**(n=2)**	
Tillering ability			100			50
Plant height			100			50
Tolerance to submergence			100			50
Tolerance to insect		50	50			50
Tolerance to diseases			100			50
Lodging resistance			100			50
Overall performance	50		50	50		
Grain yield	50		50	50		50
Easy to harvest		100			100	
Easy to thresh		100			100	
Milling recovery			100			100
Market price		100			100	
Cooking quality		50	50	50		50
Eating quality		50	50	50		50
Storage quality		100			100	

OM 6161 was better than farmers' rice varieties (IR50404 and OM 5451) in terms of tillering ability, tolerance to submergence, grain yield and eating quality. However, its market price was lower compared with farmers' rice varieties. The other positive traits are similar to those of farmers' rice varieties (Table 8).

Table 8. Farmers' perception regarding to tested varieties OM 6161

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
OM 6161 (tested at flood prone)		**(n=2)**			**(n=2)**	
Tillering ability			100			100
Plant height			100			100
Tolerance to submergence			100		50	50
Tolerance to insect		100			100	
Tolerance to diseases		100			100	
Lodging resistance		50	50		50	50
Overall performance			100			100
Grain yield			100			100
Easy to harvest		100			100	
Easy to thresh		100			100	
Milling recovery		100			100	
Market price	100			100		
Cooking quality			100			100
Eating quality			100			100
Storage quality		50	50		50	50

OM 3673 is better than farmers' existing varieties (as IR50404, OM 6976, OM 5451) in terms of its tolerance to insects and diseases, tolerance to lodging. Its grain yield and milling recovery are high but not much better than farmers' rice variety. Its overall performance is better than farmers' existing varieties (Table 9)

TLR 397 is better than farmers' existing varieties (as OM 6976, OM 5451) in terms of tolerance to lodging, submergence, tolerance to insects and diseases. Its milling recovery is same as farmers' rice varieties. Its overall performance is better than farmers' existing varieties (Table 9).

Table 9: Farmers' perception regarding to tested varieties compared with farmers' existing variety in South Viet Nam, 2014

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	***Same as farmer's existing variety***	***Better than farmer's existing variety***	***Worse than farmer's existing variety***	***Same as farmer's existing variety***	***Better than farmer's existing variety***
OM 3673 (tested at flood prone and saline prone)		**(n=31)**			**(n=31)**	
Tillering ability	13	52	32	10	61	29
Plant height	19	52	26	6	68	26

Agronomic parameters	Male farmers' perception (%)			Female farmers' perception (%)		
	Worse than farmer's existing variety	*Same as farmer's existing variety*	*Better than farmer's existing variety*	*Worse than farmer's existing variety*	*Same as farmer's existing variety*	*Better than farmer's existing variety*
Tolerance to submergence	6	61	29		81	19
Tolerance to Insect		16	81		23	77
Tolerance to diseases		6	90		6	94
Lodging resistance	6	32	58	10	35	55
Overall performance	13	19	65	19	3	77
Grain yield	29	39	29	29	39	32
Easy to harvest		97			100	
Easy to thresh		97			100	
Milling recovery	16	61	19	16	81	3
Market price	45	39	13	48	45	6
Cooking quality	6	71	19	6	81	13
Eating quality	19	42	35	23	35	42
Storage quality	13	74	10	3	94	3
TLR 397 (tested at flood prone)		**(n=2)**			**(n=2)**	
Tillering ability		50	50		50	50
Plant height			100			100
Tolerance to submergence			100			100
Tolerance to insect			100			100
Tolerance to diseases			100			100
Lodging resistance		50	50			100
Overall performance			100			100
Grain yield	50		50	50		50
Easy to harvest		100			100	
Easy to thresh		100			100	
Milling recovery		100			100	
Market price			100			100
Cooking quality		100			100	
Eating quality	50		50		50	50
Storage quality		50	50		50	50

With regards to the comparison of grain yield and milling recovery rates between test varieties and farmers' existing rice varieties, rice yields and milling recovery rates of OM 7347 and Can Tho 2 in flood prone area was higher than farmers' rice varieties. Yields and milling recovery rates of the other tested varieties under farmer managed trials were not better than farmers' rice varieties.

In flood prone area and saline prone area, the yield of tested variety OM 3763 is higher than farmers'rice variety as OM 6976 but not higher than other farmers' rice varieties as IR50404 and OM 5451. Its milling recovery is high and similar as farmers' rice varieties.

Tested rice variety TLR 397 in flood prone area shows that tested rice has higher yield and

milling recovery than farmers' rice (as OM 5451 and OM 6976).

In saline prone area, the yields of tested varieties OM 6677 and OM 8108 were higher than farmers' rice varieties but had lower milling recovery rates (Table 10).

Farmers gave their overall comments about tested varieties and showed that the tested varieties have certain positive traits and tolerance to submergence in flood prone area and salinity in saline prone area at certain level but have some disadvantages which are need to further improvement to meet the demand of farmers in their locality. The varieties as OM 10252, OM 90 L and TLR378 are not ready for dissemination. The rest of the tested varieties need to have some more improvement.

Table 10. Yield and milling recovery performance of tested varieties under farmer-managed trial

Variety name	Number of farmers	Area planted /farmer (ha)	Grain yield (t/ha)	Percent of milling recovery (%)
Flood prone area				
Farmer existing variety	31	1.118	5.95	61.7
Tested variety				
OM 7347	4	0.037	6.71	64.5
Can Tho 2	3	0.006	6.43	80.0
Can Tho 3	2	0.004	5.70	63.0
OM 10041	2	0.010	5.30	55.0
OM 4488	13	0.421	5.73	61.1
OM 6161	2	0.005	5.85	50.0
OM 7L	4	0.015	5.82	60.6
OM 8108	7	0.024	5.82	60.9
OM 3673	31	0.1274	5.2	58.4
TLR 397	2	0.275	5.6	63.5
Saline prone area				
Farmer existing variety	20	1.255	5.85	63.3
Tested variety				
OM 10252	9	0.068	4.69	63.4
OM 4488	3	0.020	5.77	60.0
OM 6677	3	0.007	6.20	60.0
OM 8108	2	0.024	6.75	
OM 90L	2	0.215	5.75	62.0
TLR378	6	0.076	3.58	64.5

CONCLUSIONS

Through PVS farmer-managed trials, men and women farmers were able to test the improved rice varieties introduced by the CLUES project and compare them with varieties which farmers commonly grow. These improved varieties are tolerant to submergence and floods, salinity, acidic soils, tolerant to insect pest and diseases. Based on farmer-managed trials, the test varieties namely OM 8108 and OM 4488 proved to be tolerant to both salinity and submergence. However, farmers' varieties have higher milling recovery, aroma and higher yields than the test varieties namely OM 8108 and OM 4488. The test varieties which were not

acceptable to farmers were OM 10252, TLR 378, OM 7L, OM 90L. In the flood prone area, OM 7347 was better than farmers' existing varieties in terms of tolerance to submergence, insect, disease, and lodging. It has good tillering ability, grain yield and eating quality. This test variety is acceptable by farmers in the flood prone area. Can Tho 2 variety was better than farmers' rice varieties but it's milling recovery has to be increased. OM 6677 was better than farmers' existing rice varieties in terms of tolerance to submergence/salinity, and insect pest. It has high tillering ability, grain yield, cooking and eating quality. However, it lodges during the wet season. OM 6161 was better than farmers' rice varieties in terms of tolerance to submergence, grain yield and eating quality. Some traits such as resistance to lodging needs to be improved. OM 10041 is more tolerant to submergence, lodging, insect and disease than farmers' variety. However, its yield is lower than farmers' varieties and need to be improved. OM 3673 is better than farmers' existing varieties in terms of its tolerance to insects and diseases, tolerance to lodging and acidic soil. However, its softness after cooked need to be improved. TLR 397 is better than farmers' existing varieties in terms of its tolerance to lodging, submergence, insects and diseases. It produces high yield and good eating quality. This variety needs to have further testing.

RECOMMENDATION

The test rice varieties which were evaluated by farmers on their own fields need to be further tested in areas which suffer from abiotic stresses such as deep floods and severe stresses and severe salinity (more than 4g/l). Rice breeders should continue to develop rice varieties which are tolerant to salinity and deeper flooding conditions. PVS is a useful approach in exposing farmers to more lines/varieties which are tolerant to abiotic stresses which are exacerbated by climate change. However, social scientists and plant breeders should work together with farmers to have more immediate feedback on the test varieties. Farmer-managed trials should also be expanded to ensure that the test varieties can perform better than farmers' varieties not only in terms of agronomic performance (high yields, etc) but also in terms of post-harvest, cooking and eating qualities which women are also more concerned with. Rice varietal improvement projects should increase and ensure the participation of women farmers in evaluating new varieties at the early stages of the research processes. Women should not only be involved in the participatory varietal selection but also in the seed distribution and training activities. When men migrate to the cities for short-term or long-term periods, women are left to manage the farms. Thus, rice breeders, extension agents and local managers need to increase more male and female farmers in testing the new technologies to improve the characteristics of technologies in such a way to suitable to their localities and adaptive well under climate change.

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TÓM TẮT

Phản hồi của nông dân về giống lúa trồng thử nghiệm do nông dân quản lý

Các giống lúa đã được nông dân trồng trong năm 2012, 2013 và trước năm 2012 có nhiều đặc tính nông học tốt và dễ tiêu thụ ngoài thị trường. Những giống này thích ứng tốt tại địa phương khi có biến động về thời tiết. Các giống lúa cần có đặc tính chống chịu cao hơn nữa để đáp ứng tốt khi ngập, mặn, phèn, sâu bệnh xảy ra nghiêm trọng hơn do biến đổi khí hậu. Các giống lúa mới từ các nhà chọn tạo giống được nông dân tự trồng thử nghiệm cho thấy rằng OM 8108 và OM 4488 chống chịu được mặn và ngập nhưng cần phải cải tạo mùi thơm, tỷ lệ gạo sau khi xay chà và năng suất trước khi phổ triển vào vùng nhiễm mặn và vùng có khuynh hướng bị ngập. Giống lúa OM 6677 chống chịu được mặn và ngập nhưng cần cải thiện tính đổ ngã do rạ yếu trong vụ mùa mưa và nên đưa cả hai gene chống chịu mặn và ngập vào giống này. Giống OM 7347 (=Can Tho 1) thích hợp cho vùng có khuynh hướng bị ngập và cần đưa gene chống chịu ngập vào giống này. Các giống OM 10252, TLR 378, OM 7L, OM 90L chưa sẵn sàng cho phổ triển và cần cải thiện nhiều đặc tính. Các nhà chọn tạo giống, cán bộ khuyến nông và cán bộ quản lý địa phương cần gia tăng sự tham gia của nam nữ nông dân trong thử nghiệm kỹ thuật mới để cải thiện các đặc tính của kỹ thuật sao cho phù hợp với địa phương và thích ứng tốt với biến đổi khí hậu.