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UNDERSTANDING FARMERS' PREFERENCES THROUGH THE PARTICIPATORY VARIETAL SELECTION (PVS) IN THE FLOOD-PRONE RICE AREAS OF THE MEKONG DELTA, VIET NAM

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ABSTRACT

Every year, resource-poor rice farmers in the Mekong Delta experience varying types of flooding causing yield loss of about 20-100%. Since rice is the main source of livelihood in the rural areas, frequent floods have contributed to increased poverty. To avert this impact of flooding, farmers need submergence-tolerant rice varieties with desired traits and appropriate management practices. Along with the breeders' selection, farmers' preferred traits are also important in defining breeding goals for wider acceptability of new varieties. This study used participatory varietal selection (PVS which provide opportunities for male and female farmers' to express their preference for rice varieties at the early stages of the breeding process. Rice varieties introgressed with the SUB1 gene and other lines possessing SUB1 were evaluated on-farm to test their performance and facilitate their adoption. In the Mekong Delta, there was significant moderate correlation between male and female farmers' preference scores, indicating they somewhat agree on the best performing varieties. There was also moderate to strong agreement between the farmers' preferences and the researchers' good performing varieties. The traits crucial to the farmers included resistance to pest and diseases, high yield, stiff/sturdy stem for lodging tolerance, good eating quality, tolerance to acid sulfate soils, good seed vigor, short duration, high tillering capacity, longer stalks, appropriate for existing cropping systems, and less fertilizer requirement. This study employed needs-based and participatory approaches to ensure that breeding programs are well-targeted and can contribute to fast track dissemination of submergence-tolerant rice varieties. The ultimate goal is increasing rice productivity and reducing poverty in flood-prone ecosystems.

Key words: participatory varietal selection (PVS), submergence-tolerant rice, SUB1 gene, trait preferences

INTRODUCTION

Rice production in Viet Nam is not only considered as one aspect of Viet Nam culture but also for national food security and export. However, rice production is always at risks due to both the vagaries of weather and pests infestation. Thus there is a need to develop rice varieties which can recover from floods/submergence. Given this situation, submergence tolerant rice varieties which can withstand 12 to 15 days were developed by plant breeders in collaborators with crop physiologists. To facilitate and accelerate adoption of these submergence tolerant varieties, it is necessary to identify men and women farmers' criteria and preferences in selecting rice varieties in their specific rice environments (Borjas 1997). Moreover, it is important to recognize and incorporate the knowledge and experience on women farmers who contribute significantly in rice farming as unpaid workers and as farm managers in Viet Nam (Chi et al. 1995).

The major objective of this paper is to understand male and female farmers' criteria and preferences in selecting rice varieties in their specific rice environments in the Mekong Delta, Viet Nam.

METHODOLOGY

1. Site selection

This study as well as on-farm trials on rice varietal improvement for submergence tolerant varieties were conducted in Long An and Hau Giang provinces located in the Mekong Delta Vietnam.

2. Participatory varietal selection (PVS). This farmer participatory process includes research-managed trials, quality test (organoleptic or sensory) and farmer-managed trials. This was followed by farmer-managed trials wherein farmers evaluate rice lines on their own plots using their level of inputs and management by comparing the performance of new rice lines with local check or most popular variety. Both male and female farmers assessed the eating and cooking qualities of the farmer-preferred lines through sensory evaluation or organoleptic tests.

2.1 ***Researcher-managed trials.*** In these trials farmers select the best and worst lines from a set of lines/varieties (unreleased lines including the new submergence tolerant line, elite varieties, local check) through visual ranking at ripening stage of the rice plants during the wet season in 2008. Preference analysis was conducted to assess the preferences between males and females and farmer *vs* researchers. Since the set of rice lines/varieties included in the researcher-managed trials had uniform plant duration and plant height, the time of preference analysis was decided when the line/variety were already mature (80% of grain ripening crop growth). Farmer preference analysis was conducted to compare male and female farmers' preferences as well as researcher/non-researcher preferences.

2,1.1 ***Preference analysis.*** Farmers' preference were gathered through voting process and by assigning codes *eg.* V1 to V24 for each line/variety. . This was done to remove the bias from selecting lines/varieties selected by plant breeders. Seven female and 22 male farmers in Thang My village (Hau Giang province) and 7 female and 11 male farmers in Choi Moi village (Long An province) participated in preferences analysis. These farmers were allowed to "vote" for their preferred varieties during a field day by depositing paper ballots in a bag or envelope in front of the plot. Ballots with 'Y' (most preferred) and ballots with 'X' (least preferred) were prepared with three colors: blue, pink, and yellow. Blue ballots were given to male farmer-participants; pink ballots to female participants and yellow for breeders/researchers. Two ballots with 'Y' letters and two ballots with 'X' letters were given to 2 rice varieties that they like best (designed positive votes) and 2 rice varieties that they most dislike (designed as negative votes). These were the raw data collected to know total positive and negative votes for a rice variety. Seven female and 22 male farmers in Thang My village (Hau Giang province) and 7 female and 11 male farmers in Choi Moi village (Long An province) participated in preferences analysis.

2.1.2 Preference scores Preference analysis (PA) generates two kinds of data: (a) quantitative preference score for each variety, expressed as the number of votes it received divided by the total number of votes cast, and (b) qualitative opinions of male and female farmers on why they like and dislike new lines/varieties. Farmers' opinions were discussed immediately after tallying the votes during the field visits. .

The preference score (PS) for each variety is calculated as follows:

$$\mathrm{PS}=\frac{\mathrm{Number\,of\,positive\,votes}-\mathrm{negative\,votes}}{\mathrm{Total\,number\,of\,positive\,and\,nagative\,votes}}$$

The preference scores for males and females were presented. However, identification of the "most" and "least" preferred varieties or selection was based on the combined male and female farmers' preference scores.

Pearson Correlation (PC) was used to investigate the relationships between two variables (x and y). This answers the question: "is the change in one variable, associated with the change in the other variable?" We used the PC to test the statistical significance of the association. The interpretation is that a significant correlation only shows that the two factors or variables vary in a related way (positively or negatively). This technique was used to test whether preference scores between male and female farmers as well as between researchers and farmers were significant

correlation or not. If PC's coefficient (r) is positive, there is a direct correlation on preference score between male and female as well as between researchers and farmers.

Pearson Correlation was also used to investigate the relationships between rice yield and farmers' preference score. If correlation coefficient (r) is positive, there is a direct correlation on farmers' preference score between and yield. If r is negative, there is an inverse correlation on preference score between farmers and yield.

The level of correlation was classified based on r as following:

0.00	- no correlation
0.01-0.20	- very weak correlation
0.21-0.40	– weak correlation
0.41-0.60	– moderate correlation
0.61-0.80	– strong correlation
0.81-0.99	– very strong correlation
1.00	– Perfect correlation

2.2 Farmer-managed trials

During the wet season 2009, eighteen farmers participated in the farmer-researcher managed trials. The seeds used for these trials were obtained from the researcher-managed trials. Thus the plot areas of the farmer-managed trials for each line/variety was also small due to the low quantity of available seeds. Moreover, in Long An site, the project staff members had to follow the suggestion of the extension officers of the commune to give more seeds to two farmer cooperators, thus the rest of the farmers received fewer seeds (1.8kg/each variety). The two submergence tolerant varieties with Sub-1 gene namely IR84194-9 and IR82355-5-2-3 which were selected during preference analysis were grown by farmers in Long An province.

Similarly, in Hau Giang province, farmers evaluated seeds selected in the researcher-managed trials in 2008. However, the lines/varieties preferred in the research sites were OM 4900, IR05F102 (Swarna-Sub1) and OM6065. Another variety from Bangladesh named BR 11 which was selected by both extension staff members and farmers was also added in the farmer-managed trial. Ten farmers received three lines/varieties namely OM 4900, IR05F102 (Swarna-Sub1) and BR11 with 1.3kg seeds/variety. Only one farmer received the variety named as OM6065 due to limitation of seeds. Each variety was planted on 0.01 – 0.025ha.

To monitor the performance of the new lines/varieties, a structured questionnaire was used to interview farmers on the soil and flood condition, yield and other opinions from the farmer. Farmers were also asked whether she/he will grow the new line/variety next cropping season. Extension workers also visited the farmers several times to monitor the performance of the rice lines/varieties.

2.3 Sensory evaluation. Male and female farmers were asked to assess the eating and cooking qualities of the lines/varieties included in the farmer-managed trials. Each cooked line/variety was given a code to avoid bias and ranked based on specific weights for a given criteria.

RESULTS AND DISCUSSIONS

1 Site characterization

The research sites included in this study are subjected to floods caused by high tides, heavy rains due to typhoon and tropical low pressure in the Mekong Delta (South Viet Nam). When the high tide occurs at the same time with tropical low pressure or typhoon, the affect of flood is more severe According to Quang Tuan (2009) of the Ministry of Natural Resources and Environment, as the temperature and annual rainfall increases, 20% of total area in the Mekong Delta (South Viet Nam) will be flooded when sea water increases 75cm, and one-third of this area are submerged if sea water level increases 100cm. Thus the Mekong delta (South Vietnam) is an important area for dissemination of submergence tolerant rice varieties. If rice breeders can develop varieties that can tolerate submergence/floods for one month more, then rice production can be ensured despite severe climate conditions.

The main cropping system in both studied sites in Long An and Hau Giang provinces is double rice. In Long An site, the cropping calendar of dry season starts in November/December in the previous year and harvests from February to March in the following year; the wet season starts from April to May and harvests from July to

August. In Hau Giang site, dry season starts in November of the previous year and harvests in February of the following year; the wet season starts in April and harvests in July.

Rice production environment is based on availability of irrigation; irrigation system in research sites (in Hau Giang and Long An provinces) is available for both wet and dry season. However, in Long An site, water irrigation was 80% in wet season and 92% in dry season, the rest can get water from gravity.

Farmers in Long An had larger rice cultivated area than those in Hau Giang province. The average rice areas are 2.4 ha and 0.56 ha in Long An and Hau Giang, respectively. The soil textures in Long An varied, mostly humus and loamy. The rest are clayey, grey soil, or loamy with sandy and loamy with clayey. In Hau Giang, the soil is mostly loamy with clayey. Most of the soil in Long An and Hau Giang is fertile (60% in Long An and 87.5% in Hau Giang). The lands are all low land rice, irrigated and all have land use right. Two thirds of the lands for researcher-managed trials suffer from floods/submergence.

More male than female farmers involved in farmer managed trial. The farmer cooperators are in middle age (38-40 years old) and all are Vietnamese majority. Male farmer cooperators obtained higher education (7 years in school in Long An and 11 years in Hau Giang) than female cooperators (6 years in school in Long An and 9 years in school in Hau Giang) and male experienced more years in farming (26 years in farming in Long An and 7 years in Hau Giang) than female farmer cooperators (23 years in Long An and 4 years in Hau Giang). Farmers in both sites have land use right certificates. The average household size of farmer cooperators is 5.

In Long An province, the poverty incidence of the province was 12.37% with 39,943 poor households (Long An People Committee, 2008). In 2007, the poverty incidence in Hau Giang province was 18.89% (Hau Giang People Committee, 2007). However, based on the report on implementing of decision No. 32/2007 QĐ-TTg by Prime Minister on Hau Giang, the poverty rate in Hau Giang in 2007 was 18.89%.

The gross household income in Long An was 106,661 thousand VN dong (5,925 USD) in normal year and 81,694 thousand VN dong (4,538 USD) in flood year. This was 24,561 thousand VN dong (13,654USD) in normal year and VND 23,539 thousand ($ 1,307) in flood year in Hau Giang. In both sites, the main source of income was from rice (60%). The rest of income sources were off-farm and non-farm, animal husbandry, and selling other assets.

Regarding to gender role, in the studied sites, both male and female roles were important in rice farming. On own rice farms, the wives participated more than the husbands in transplanting, gap filling, weeding, removing off-types, drying, keeping cash after selling rice products, and preparing food for labors. The husbands participated more than the wife in land preparation, application of fertilizer and chemicals, and seed selection. Wife also participated in heavy tasks as land preparation (62% of the households) and application of chemical (31% of households). Husband and wife equally shared in pulling of seedlings, harvesting and selling rice products.

On the other farms, the wife participated more than husband in pulling of seedlings, transplanting for gap fillings and weeding. Husband involved more than wife in land preparation, application of fertilizer and chemicals. Wife also participated more than husband in animal raising meanwhile husband participated more than wife in aquaculture, catching fish, and non-farm works. With this background, women had experience as men in rice farming and knowledge in evaluation the performance of a rice variety.

2. Participatory varietal selection (PVS)

2.1. 1.Farmer preference scores of lines/varieties included researcher-managed trials

During the wet season 2008, we conducted researcher-managed trials which include 25 lines/varieties. Table 1 shows the summary the preferences of male farmers, female farmer, combined farmers and research in Thang My village in Hau Giang province. Male farmers like OM 4900 and IR05F102 (Swarna-Sub1) while female farmers like BR11 and OM6065. When

male and female farmers' votes were combined, the most preferred lines are OM4900, IR5F102 (Swarna-Sub1) and OM6065. The preference score of researchers showed that OM4900 was the best performing variety.

Table 1. Preference analysis by farmers in Thang My village (Phung Hiep, Hau Giang) (2008 wet season)

Variety Code	IRRI No.	IRRI code	Common name	Preference Scores			
				Male Farmer	Female Farmer	Combined Farmers	Researcher
V1	OM 4900			**0.136**	0.000	**0.103**	**0.167**
V2	IR 07F102		IR 64 Sub1	-0.023	0.000	-0.017	0.000
V3	IR 05F102	IR82810-407	Swarna-Sub1(B3F3)	**0.114**	0.071	**0.103**	0.083
V4	IR 07F287	IR84196-32		-0.080	0.000	-0.06	0.000
V5	IR 07F289		TDK1 Sub1	0.000	0.000	0	0.083
V6	IR 07F291		CR1009 Sub1	-0.023	0.000	-0.017	-0.083
V7	IR 07F290		BR11 Sub1	0.011	0.000	0.009	-0.083
V8	IR 66876 -11 NDR -1-1 -1-1			0.000	0.000	0	0.083
V9	IR 57514 PMI-5-F-1-2			0.000	0.000	0	0.000
V10	IR 49830 7-1-2-3			0.000	0.000	0	0.000
V11	IR 82355 5-1-3			-0.011	0.000	-0.009	-0.083
V12	IR 82355 5-2-3			-0.080	-0.143	-0.095	-0.083
V13	PSB Rc68			-0.011	-0.071	-0.025	0.083
V15	IR 05F107			0.023	0.071	0.034	0.000
V16	IR 07F101		Samba Mashuri Sub1	-0.011	0.000	-0.009	-0.083
V17	IR 64			-0.023	0.000	-0.017	0.000
V18	IR05F101		Swarna Sub1(B2F3)	-0.023	0.000	-0.017	0.000
V19	Mahsuri			-0.057	0.000	-0.043	0.000
V20	IR 43569			-0.023	-0.143	-0.052	0.000
V21	CR 1009			-0.057	0.000	-0.043	-0.083
V22	BR 11			0.034	**0.143**	0.06	0.000
V23	OM 6873			0.011	0.000	0.009	0.000
V24	OM 6877			-0.011	-0.143	-0.043	0.000
V25	OM 6065			**0.102**	**0.214**	**0.129**	0.000

Table 2 shows the summary of the preference analysis for sixteen lines/varieties by farmers in Choi Moi village in Long An province. In Long An province, male farmers like IR 82355-5-2-3 and IR 84194-9 while female farmers like VND 95-20 (local check) and IR 82355-5-2-3. Both male and female farmers prefer IR 82355-5-2-3. The researchers evaluated that IR 82355-5-2-3 ; IR 84194-9 and IR 84194-139 had good performance as local check VND 95-20.

Table 2. Preference analysis by farmers in Choi Moi village (Vinh Hung, Long An) (2008 wet season)

Variety Code	Common name	IRRI code	Preference Scores			
			Male Farmer	Female Farmer	Combined Farmers	Researcher
V2	IR 84196-32		-0.045	-0.107	-0.069	-0.050
V3	VND 95-20 (local check)		0.045	**0.143**	0.083	**0.100**
V4	IR 82355-5-1-3	IR 82355-5-1-3 (IR 05A193)	0.000	0.000	0	0.050
V5	IR 82355-5-2-3	IR 82355-5-2-3(IR 05A199)	**0.091**	**0.179**	**0.125**	**0.150**
V6	IR 84193-36		-0.045	-0.214	-0.111	-0.200
V8	IR 85264-141		0.000	0.000	0	-0.150
V9	PSB Rc68		-0.068	-0.036	-0.056	0.000
V10	IR 85260-148		-0.045	-0.036	-0.042	0.000
V11	IR 84194-9		**0.159**	0.036	**0.111**	**0.100**
V12		IR66876-11-NDR-1-1-1-1	-0.114	-0.036	-0.083	-0.050
V13		IR 57514-PMI-5-B-1-2	-0.045	0.036	-0.014	-0.050
V14	IR 84194-139		0.023	0.000	0.014	**0.100**
V16	IR 82810-407		0.045	0.036	0.042	0.000

2.1.2 Evaluation of lines/varieties included researcher-managed trials. As shown in Table 3, the differences between male and female farmers' preference scores were moderate and significant in Thang My village (Hau Giang province). This means that with r= 0.551 (at 1% level of significance), male and female farmers somewhat agree on their preferences for the best performing varieties tested in the researcher-managed trials. Similarly, in Choi Moi village (Long An province), there was significant and moderate correlation between the male and female farmers' preference scores. This means that with r= 0.590 (at 5% level of significance), male and female farmers somewhat agree on their preferences for the best performing varieties tested in the researcher-managed trials. However, the correlation analysis between farmers and researchers also show moderate correlation at r= 0.466 and 5% level of significance in Thang My village in Hau Giang province. In Choi Moi village (Long An province), when farmers' preferences (male and female preferences combined) are compared to the researchers' preferences, the correlation analysis shows moderate correlation at r= 0.772 and 1% level of significance. The results show that there is strong agreement between the farmers' preferences, given their own reasons and set of criteria for selection, and the researchers' own criteria in selecting good performing varieties.

Table 3. Correlation analysis of preference scores of male and female farmers and researchers, 2008 wet season.

Sites (Village, Province)	Farmers (No)		Entries (No)	Correlation between male and female farmers (r)	Correlation between farmers and researchers (r)
	Male	Female			
Thang My, Hau Giang	22	7	25	0.551***	0.466**
Choi Moi, Long An	11	7	16	0.590**	0.772***

** Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed)*

2.1.3 Reasons for preference for lines/varieties. Based on preference analysis, in Thang My village (Hau Giang province), OM6065, OM4900 and IR05F102 rice varieties were most preferred by farmers. OM6065 was preferred for its long panicle and presence of "many sub – panicles" called "nhieu bong con" by farmers. This means that aside from the main panicle in the middle of rice plant, there are smaller panicles around. This variety also showed compact seeds or more grains per panicle; erect flag leaf with relatively acceptable light green (to some farmers described as good color -yellow green- indicative of potential higher yield). Farmers do not select varieties with dark green or too light green as these are usually the low-yielding types. The leaves of OM6065 also did not show any sign of disease.

OM4900 and IR05F102 had same good characteristics that were preferred by farmers. Long panicle, more hidden panicles as farmer called "dau bong" means the panicles were not totally exposed or were partly hidden by the longer flag leaf. This makes it less vulnerable to bird attack. The varieties also had compact seeds, long grains, and less signs of grain spots or any grain disease based on grain coloration.

In Long An province, IR82355-5-2-3 and IR84194-9 were most preferred by farmers in Choi Moi village. IR82355-5-2-3 was observed with good characteristics as short duration, more panicles, compact or dense seeds (both give the indication of better yields), stiff stem (this can make the plant less susceptible to lodging), and absence of brown planthopper infestation. IR84194-9 was preferred by farmers because of less signs of disease, short duration, long panicle, compact seeds, thin rice husk (the cover of rice grain is thin - this means the kernel inside has bigger and heavier weight).

2.1.4 Correlation between farmers' preference scores and yields. As shown in Table 4, there was no correlation between farmers' preferred lines/varieties and yields were farmers' score for the preferred lines/varieties in Thang My village (Phung Hiep district, Hau Giang province), farmers' perceptions of good performing varieties were captured through the preference score is weak association with the researcher-calculated yields for the entries in the researcher-managed trials, given that the correlation (r=0.369 is not significant. These results are due to the crop failure. According to the researcher who in-charged for managing the trials, due to delay in planting and harvesting the lines/varieties in the researcher-managed trials, the birds attacked the crops thus resulting to low yields (Table 4).

In Choi Moi village (Vinh Hung district, Long An province), farmers' perception of good performing varieties captured through the preference score is weak association with the researcher-calculated yields for the entries in the researcher-managed trials, given that r= -0.237 (that is not significant correlation). Similar situation as in Hau Giang was found, the rice field was attacked by birds due to late planting as compared to surrounding fields. According to focus group discussion in the studied sites, the normal rice yield were from 5.3 to 6.5 t/ha in dry season and 4.5 to 5.0 t/ha in wet season. Thus, in this case, the drop yields due to bird attack were significant. The yields in research managed trial during wet season were significantly low die to bird attack, yields in Long An varied from 3.16- 3.8 t/ha and in Hau Giang from 0.39 to 4.38 t/ha. This perception indicates that yields are not the only criteria for selecting rice varieties but due to many other factors. This is why PVS is important.

Table 4. Correlation analysis for relation between farmers' scores and rice yield (2008 wet season, South Vietnam).

Sites (Village, Province)	Farmers (No)		Entries (No)	Correlation between farmers and yield (r)
	Male	Female		
Thang My, Hau Giang	22	7	25	0.369 ns
Choi Moi, Long An	11	7	16	-0.237 ns

ns: not significant

2.2 Evaluation of new lines/varieties under farmers' management

2.2.1 Farmers' preference for new rice lines/varieties

Most of farmers reported that the stagnant flood occurs nearly during the harvest season. Among the eighteen farmers involved in the farmer-managed trials, only five of them experienced flash floods four to twenty one after sowing which lasted from six to ten days. They observed that 100% of the new lines/varieties survived while 50% their existing rice varieties totally died.

IR82355-5-2-3, a submergence tolerance variety is rated better than farmers' existing rice varieties in terms of tillering capacity, tolerance to submergence, insect pest, diseases, and resistance to lodging. Its post harvest traits such as easy to harvest and thresh, milling recovery, cooking, and eating quality and storage quality are similar to farmers' varieties. However, the grain yield is not better than farmers' variety. The market price is lower compared with farmers' existing varieties because it is too new and the traders do not know well about it. Marketing their products is important to farmers for wide adoption of this variety. This evaluation is based only for trial for one season (Table 5).

IR64-Sub1 (IR84194-9), another submergence tolerance variety **is** better than farmers' existing rice varieties in terms of plant height, tolerance to submergence, diseases and lodging resistance. Several traits of IR 64-SUB 1 are similar to farmers' existing varieties such as grain yields, tillering capacity, tolerance to insect pest, easy to harvest, easy to thresh, milling recovery, market price, cooking and storage quality. There are other traits of farmers' varieties for example eating quality, which is better than this new variety.

SWARNA-SUB1, a new variety which is tolerant to floods/submergence which has its origin in India is better than farmers' existing varieties in terms of tolerance to submergence, insect pest, diseases, and lodging resistance. Its traits that are similar to farmers' existing varieties include plant height, easy to harvest, easy to thresh, milling recovery, cooking, eating and storage quality. However, its grain yield is lower compared with farmers' varieties. Grain yield is the most important criteria in varietal selection of both male and female farmers (Chi, et al. 1999). The market price is not known because of small harvest and farmers did not sell.

Table 5. Farmers perception regarding submergence tolerance varieties compared with farmers' existing varieties in Long An and Hau Giang provinces, South Vietnam, Wet Season 2009 (%)

Agronomic Parameters	**IR82355-5-2-3**				**IR64-SUB1 (IR84194-9)**				**SWARNA-SUB1**			
	(n)	Worse	Same	Better	(n)	Worse	Same	Better	(n)	Worse	Same	Better
Tillering ability	18	0.0	28.0	72.0	6	0.0	67.0	33.0	16	13.0	44.0	43.0
Plant height	18	39.0	28.0	33.0	6	0.0	33.0	67.0	16	38.0	56.0	6.0
Tolerance to Submergence	14	0.0	14.0	86.0	4	0.0	0.0	100.0	16	0.0	50.0	50.0

Agronomic Parameters	IR82355-5-2-3				IR64-SUB1 (IR84194-9)				SWARNA-SUB1			
	(n)	Worse	Same	Better	(n)	Worse	Same	Better	(n)	Worse	Same	Better
Tolerance to Pest	18	22.0	22.0	56.0	6	0.0	67.0	33.0	16	38.0	6.0	56.0
Tolerance to Diseases	18	22.0	22.0	56.0	6	17.0	33.0	50.0	16	25.0	12.0	63.0
Lodging Resistance	18	0.0	28.0	72.0	6	0.0	17.0	83.0	16	0.0	38.0	62.0
Overall Performance	18	22.0	28.0	50.0	6	33.0	17.0	50.0	16	0.0	56.0	44.0
Grain yield	18	33.0	39.0	28.0	6	0.0	100.0	0.0	16	62.0	38.0	0.0
Easy to harvest	18	0.0	94.0	6.0	6	0.0	67.0	33.0	16	0.0	100.0	0.0
Easy to thresh	18	0.0	94.0	6.0	6	0.0	100.0	0.0	16	0.0	100.0	0.0
Milling recovery	18	0.0	89.0	11.0	6	0.0	67.0	33.0	16	0.0	100.0	0.0
Market price	18	67.0	33.0	0.0	6	33.0	67.0	0.0	16	-	-	-
Cooking quality	18	6.0	94.0	0.0	6	0.0	100.0	0.0	16	0.0	100.0	0.0
Eating quality	18	17.0	78.0	5.0	6	0.0	50.0	50.0	16	0.0	100.0	0.0
Storage quality	18	0.0	100.0	0.0	6	0.0	100.0	0.0	16	0.0	100.0	0.0

(n): number of responses

Farmers' evaluation of new rice varieties tested in the farmer-managed trials in Hau Giang is presented in Table 6. The variety BR11 is better than farmers' existing varieties in terms of tillering capacity, tolerance to insect pest, diseases, and lodging resistance. The other traits as easy to harvest, easy to thresh, milling recovery, cooking, eating and storage quality are same as farmers' varieties. The market price is not known because of small harvest and farmers did not sell.

OM 6065, a new variety developed in Vietnam, is preferred by farmers than their existing rice varieties due to its positive traits such as as tillering capacity, plant height, tolerance to insect pest, diseases, lodging resistance, and grain yield. This variety has similar traits such as easy to harvest, easy to thresh, milling recovery, market price, cooking, eating and storage quality with existing varieties.

OM 4900, another variety developed in Vietnam is preferred by farmers' than their existing rice varieties in terms of tillering capacity, tolerance to insect pest, lodging resistance, grain yield and eating quality. The traits are same as farmers' existing varieties as easy to harvest, easy to thresh, cooking and storage quality. However, the negative traits of OM 4900 are susceptible to diseases, lower milling recovery due to thick rice husks, and thus low market price.

Table 6. Farmers' perception on new rice varieties compared with existing varieties, Hau Giang province, south Vietnam, Wet Season 2009

Agronomic Parameters	BR11				OM6065				OM4900			
	(n)	Worse	Same	Better	(n)	Worse	Same	Better	(n)	Worse	Same	Better
Tillering ability	16	0.0	19.0	81.0	2	0.0	0.0	100.0	2	0.0	0.0	100.0
Plant height	16	34.0	34.0	32.0	2	0.0	0.0	100.0	16	50.0	0.0	50.0
Tolerance to Submergence	16	13.0	56.0	31.0	2	0.0	0.0	100.0	16	0.0	50.0	50.0
Tolerance to Pest	16	0.0	13.0	87.0	2	0.0	0.0	100.0	16	25.0	19.0	56.0

Agronomic Parameters	BR11				OM6065				OM4900			
	(n)	Worse	Same	Better	(n)	Worse	Same	Better	(n)	Worse	Same	Better
Tolerance to Diseases	16	6.0	13.0	81.0	2	0.0	0.0	100.0	16	63.0	12.0	25.0
Lodging Resistance	16	0.0	44.0	56.0	2	0.0	0.0	100.0	16	0.0	44.0	56.0
Overall Performance	16	0.0	56.0	44.0	2	0.0	0.0	100.0	16	0.0	69.0	31.0
Grain yield	16	50.0	50.0	0.0	2	0.0	0.0	100.0	16	0.0	38.0	62.0
Easy to harvest	16	0.0	100.0	0.0	2	0.0	100.0	0.0	16	0.0	100.0	0.0
Easy to thresh	16	0.0	100.0	0.0	2	0.0	100.0	0.0	16	0.0	100.0	0.0
Milling recovery	16	0.0	100.0	0.0	2	0.0	100.0	0.0	16	100.0	0.0	0.0
Market price	-	-	-	-	2	0.0	100.0	0.0	16	100.0	0.0	0.0
Cooking quality	16	0.0	100.0	0.0	2	0.0	100.0	0.0	16	0.0	100.0	0.0
Eating quality	16	0.0	100.0	0.0	2	0.0	100.0	0.0	2	0.0	19.0	81.0
Storage quality	16	0.0	19.0	81.0	2	0.0	100.0	0.0	16	0.0	100.0	0.0

(n): number of responses

2.2.2 . Principal male or female perception on new line in farmer-managed trials

Principal male and female farmers gave feedback of submergence tolerance rice varieties included in the farmer-managed trials. Both males and females are of the opinion that **IR82355-5-2-3 (Sub-1 rice) is** similar as farmers' existing rice varieties in plant growth and resistance to lodging. In general, this variety requires less fertilizer or low responsive to fertilizer. However, this line/variety was slightly affected by brown planthopper (BPH) and diseases such as yellow stunt in some fields. It possesses good characteristics as long panicle, high tillering capacity, big leaf and high yield. However, it has poorer eating quality compared with farmer's variety namely VND 95-20 and Nep Chum. These varieties have high eating quality. **IR84194-9 (IR07F286 or IR64-Sub1)** is similar to farmers' existing rice varieties in terms of resistance to lodging due to short and hard stalks, It has good traits as high tillering capacity, hidden panicles, long and slender grain, thin rice husk, small grain like VND 95-20 (common farmers' existing variety), equal yield as VND 95-20. Farmers used less pesticide than farmer's variety. This variety was slightly affected by yellow leaf disease. **IR05F102 (Swarna-Sub1)** has good traits as high tillering capacity, less insect and disease, less fertilizer requirement. However, it has long duration.

According to male and female farmers, **BR11** possesses good traits as well high tillering capacity, short statured, less susceptibility to insect and disease and less fertilizer requirement. **OM6065** possesses good traits as resistance to insect pest, erect leaf and has large panicles. **OM4900** possesses good traits as high tillering capacity, less insect attack but susceptible to diseases, low milling recovery, and has more broken grains after milling.

2.3 Potential for adoption of varieties

Farmer participation in the researcher-managed and farmer-managed trials revealed that the new submergence tolerance rice varieties introduced in the project will have low potential for adoption due to lower yields and longer duration. However, they have positive traits such as resistance to insect pest and disease, lodging, and synchronized flowering.

Table 7. Agronomic performance of tested varieties under farmer-managed trial, wet season 2009

Variety name	N	Area planted (ha)	Grain yield (t/ha)	Percent of milling recovery (%)
Farmer existing variety	18	1.38	4.90	63.89
Submergence tolerant variety				
IR82355-5-2-3	9	0.18	3.76	63.44
IR84194-9 (IR07F286) or IR64-Sub1	3	0.52	4.03	64.67
IR05F102 (Swarna-Sub1)	8	0.03	3.03	64.88
New tested variety				
BR 11	8	0.02	3.68	64.88
Trial of local variety				
OM6065	1	0.02	4.80	65.00
OM4900	8	0.03	5.13	63.50

Both male and female farmers participated in farmer-managed trials have similar comments on IR82355-5-2-3. This variety has less insect pest and disease than farmers' common rice VND 95-20 and it took shorter time for flowering completion than farmers' rice variety. However, this variety has no aroma and too new to traders and difficult for farmers to sell. Male farmers also commented that IR82355-5-2-3 has low yield. Both male and female farmers commented that IR84194-9 (IR07F286 or IR64-Sub1) has thin rice husks and similar as farmers' common rice VND 95-20. Male farmers said it has less insect pest attack than VND 95-20 and has similar yield. Female farmers said that this variety does not have disease. Both male and female farmers have same comments for IR05F102 (Swarna-Sub1). This variety has less insect pest but low yield. Similarly, both of male and female farmers said that BR11 has less insect pest but low yield. Male farmers added that BR 11 has good lodging resistance because of short stalks. Male farmers commented that OM 4900 has more vigor after sowing and high yield but low milling recovery, thick rice husks, broken rice after milling. Female farmer did not give any comment on this variety.

Most farmers who conducted farmer-managed trials expressed their willingness to grow and evaluate the new rice varieties in the next season. The trial for only one season (wet season) is not sufficient for farmers to know the varieties very well. They would like to evaluate its stability in terms of yields and other desirable traits particularly its ability to recover from submergence and floods.

2.4 Sensory evaluation of the cooking and eating quality of the submergence tolerant rice and farmer's existing variety

In Long An province, the local rice variety VND95-20 is the most preferred variety as compared with submergence tolerant rice varieties because its cooked rice is softer, sweeter, more glossy, white and transparent. IR84194-9 (IR07F286 or IR64-Sub1) is the 2nd preference by farmers. IR82355-5-2-3 is least preferred because it is not transparent, not sweet as local rice variety (Table 8)

Analysis of rice preference of male and female farmers also showed that both male and female farmers preferred VND95-20 than other tested rice varieties. Thus, the breeders should consider eating and cooking qualities of the new lines/varieties in the development of submergence tolerant varieties (Table 9)

Table 8. Sensory evaluation summary of farmers in Long An province, south Viet Nam

Variety	COUNT		Relative Weight		Combined Weight	Rank
	Acceptable	Not Acceptable	Ranking	Rating		
IR82355-5-2-3	8	19	22.36	20.93	21.64	3
IR64 Sub1	18	9	37.89	38.51	38.21	2
VND95-20	24	3	39.75	40.56	40.15	1
TOTAL	50	31	100	100	100	

Table 9. Sensory evaluation summary report for male and female farmers in Long An province, south Viet Nam

Variety	COUNT				Relative Weight				Combined Weight		RANK	
	Acceptable		Not Acceptable		Ranking		Rating					
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
IR82355-5-2-3	6	2	13	6	22.80	21.28	22.11	18.13	22.46	19.70	3	3
IR64 Sub1	12	6	7	2	38.60	36.17	38.42	38.74	38.50	37.46	2	2
VND95-20	17	7	2	1	38.60	42.55	39.47	43.13	39.04	42.84	1	1
TOTAL	35	15	22	9	100	100	100	100	100	100		

Sensory test in Hau Giang indicated that two rice varieties IR05F102 (Swarna-Sub1) and OM4900 were preferred by farmers in Hau Giang province. The 1st ranked variety for their acceptability was IR05F102 (Swarna-Sub1), the 2nd ranked variety was OM4900. The local rice variety Ham Trau was ranked third.

Table 10. Sensory evaluation report for farmers in Hau Giang province, south Viet Nam

Variety	COUNT		Relative Weight			
	Acceptable	Not Acceptable	Ranking	Rating	Combined Weight	Rank
OM 4900	15	9	28.75	27.58	28.17	2
IR05F102 (Swarna Sub1)	21	3	37.50	32.92	35.21	1
BR11	0	24	7.50	13.96	10.73	4
Ham Trau	14	10	26.25	25.54	25.90	3
TOTAL	50	46	100	100	100	

Both male and female farmers preferred IR05F102 (Swarna Sub1) over the other varieties because of its good taste, sweet and soft texture as cooked rice. Among non-submergence tolerance rice varieties, female farmers preferred Ham Trau over OM4900 because of its sweet taste meanwhile male farmers preferred OM4900 over Ham Trau because of its soft texture when cooked.

Table 11. Sensory evaluation Report for male and female farmers in Hau Giang province, South Viet Nam

Variety	COUNT				Relative Weight				Combined Weight		RANK	
	Acceptable		Not Acceptable		Ranking		Rating					
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
OM 4900	10	5	7	2	27.45	31.03	26.00	31.43	26.73	31.23	3	2
IR05F102 (Swarna Sub1)	14	7	3	0	38.24	36.21	33.53	31.43	35.88	33.82	1	1
BR11	0	0	17	7	6.86	8.62	14.41	12.86	10.64	10.74	4	4
Ham Trau	12	2	5	5	27.45	24.14	26.06	24.29	26.75	24.21	2	3
TOTAL	36	14	32	14	100	100	100	100	100	100		

2.5 Famers' preferred traits under submergence/flood rice environments

Most of the male farmers prefer rice varieties which have resistance to insect pest and disease followed by high yield, tolerance to lodging tolerance and good eating quality. On the other hand, most of the female farmers prefer varieties with high yield, followed by resistance to insect pest and disease, easy to sell, resistance to lodging. Male farmers preferred the traits of tolerance to acid sulfate soils, good seed vigor, short duration, high tillering capacity, high plant, tolerance to submergence, suitable for cropping and less fertilizer requirement that were not mentioned by female farmers.

Table 12. Desired rice traits of farmer managed trial cooperators in South Vietnam by Gender, 2009

Rice traits	Male		Female		Total	
	N	Important trait (*)	N	Important trait (*)	N	Important trait (*)
Tolerance to acid sulfate soils	2	7			2	7
High yield	12	2	16	1	28	2
Resistance to pest and diseases	21	1	13	2	34	1
Good seed vigor	3	6			3	6
Resistance to lodging	8	3	2	4	10	4
Easy to sell	4	5	10	3	14	3
High price t	1	8	2	4	3	6
Short duration (90-95 days)	3	6			3	6
High tillering capacity	2	7			2	7
Long and slender grain	1	8	1	5	2	7
High plant, growing fast	1	8			1	8
Suitable for cropping (WS & DS)	1	8			1	8
Tolerant to submergence	1	8			1	8
Good eating quality	5	4	1	5	6	5
Require less fertilizer	1	8			1	8

1 is most desirable trait; WS: wet season; DS: dry season

CONCLUSIONS AND RECOMMENDATIONS

The traditional approach in on-farm rice varietal improvement often ignores the roles of male and female farmers. Often, participants in demonstration trials are male staff members from agricultural extension and other agriculture departments, seed companies and farmers. Despite the significant contributions of women farmers in rice production and post harvest activities, they are rarely included in research development and extension programs.

Both male and female farmers selection criteria for enhancing breeding work included high yield, short duration, more panicles, more sub – panicles, long panicles, more hidden panicles, compact or dense seeds, stiff stem, resistance to plant hopper and other insects, resistance to rice diseases, thin rice husk, erect and long flag leaf with relatively acceptable light green to be indicative of potential higher yield, long grains, and less signs of grain spots or any grain disease based on grain discoloration as well as good eating quality and easy to sell.

Varieties selected comprised of IR82355-5-2-3, IR84194-9 and IR05F102 for submergence tolerance rice; OM6065 and OM4900 for local rice. However, the submergence tolerance rice varieties can be temporary selected for dissemination only because they are not ready for wide adoption by farmers. Thus, they need to incorporate more farmers' desirable traits to enhance farmers' acceptability with more sustainability.

Policy support system: The policy makers should direct the biological scientists in agriculture to consider both male and female farmers in varietal selection participatory. The policy makers from provincial to district level should have directions for the recognized varieties to be disseminated to farmers in the suitable area.

- Institutional linkages and networking: The research institute, university, state and local authority, the trader, and farmers' association should form a network in testing and dissemination of suitable rice varieties for flood prone area.
- Farmers/community adaptation strategies: Farmers change some cultural practices in the flood year as increasing seed rate, fertilizer amount or timing of sowing. They expect to have submergence rice tolerant rice varieties with all traits of their preference.
- Dissemination strategies at national level: The dissemination at national level needs the direction from the ministry of agriculture to national agricultural extension, the department of agriculture and extension centers of the provinces. Moreover, the public associations play important role in technologies transfer, thus the training should be provided to these associations as women's association, farms' association, extension clubs, farmers' same preference groups, … Aside from these, variety suppliers should ensure the rice yield and the traders or food companies should have contracts of buying all the rice production after farmers' harvest to stimulate them to adopt new rice varieties.
- Research areas on participatory varietal selection: The participatory varietal selections by farmers were conducted often before harvest when the varieties were already undergone the processes of breeding. Thus, there were varieties only meet the criteria of the breeders. If farmers can participate from the beginning of the breeding process, the dissemination will be more successful.

REFERENCES

Borjas, Partricia Howard. 1997. Gender Studies in Agriculture and Rural Development. Wageningen Agricultural University. Home Center for Rural Development. Sociology. Homepage. Internet

Chi, Truong Thi Ngoc, Nguyen Thi Khoa, Bui Thi Thanh Tam, and Thelma Paris. 1995. Gender Roles in Rice farming Systems in the Mekong River Delta: an exploitary study. *In* Vietnam and IRRI: A Partnership in Rice Research, Proceedings of a Conference held in Hanoi, Vietnam, 4-7 May 1994, edited by G. L. Denning and Vo Tong Xuan. Join publication by International Rice Research Institute (IRRI)

and Ministry of Agriculture and Food Industry (MAFI), Vietnam. P. 291-299

Chi, Truong Thi Ngoc; Thelma R. Paris and Joyce Luis. 1999. Male and female farmers' participatory in rice varieties selection in Long An province, Viet Nam. Presented and Printed in "Results of Science Research for 1999" of Cuu Long Rice Research Institute (in Vietnamese).

Hau Giang People Committee. 2007. Status of Socio-Economic in 2007 (in Vietnamse). Website:http://www.haugiang.gov.vn/Portal/OtherNewsView.aspx?pageid=13&ItemID=80&mid=75&pageindex=5&siteid=1

Long An People Committee. 2008. Results of Implementing Job Solution and Poverty Alleviation for the period 2001-2005 and Orientation of Commitments for the period 2006-2010 (in Vietnamese). Website: http://www.longan.gov.vn/chinhquyen/Pages/Ket-qua-thuc-hien-chuong-trinh-giai-quyet-viec-lam-va-xoa-doi-giam-ngheo-giai-doan-2001-2005-va-phuong-huong,-nhiem-vu-giai.aspx

Quang Tuan. 2009. One-third of Mekong Delta area may be submerged. Thanh Nien Newspaper. No. 233 (4990), Friday 21 Aug. 2009. Page 3 (in Vietnamese).

Paris Thelma R, A Singh. AS Cueno, VN Singh. 2008. Assessing the Impact of Participatory Research in Rice Breeding on Women Farmers: A Case Study in Eastern Utta Pradesh, India. Expl. Agric. (2008), vol. 44. Cambridge University Press, p. 97-112

Tìm hiểu đặc tính giống ưa thích của nông dân thông qua tham gia đánh giá giống (PVS) ở vùng lúa có khuynh hướng bị ngập ở đồng bằng sông Cửu Long, Việt Nam

Để đối phó với tình hình ngập nước trong ngành trồng lúa ở đồng bằng sông Cửu Long, giống lúa có gen chống chịu ngập (Sub1) được thử nghiệm và nông dân tham gia đánh giá giống trên ruộng do cán bộ nghiên cứu quản lý và ruộng do nông dân tự trồng thử nghiệm và tự quản lý. Nam nữ nông dân cũng tham gia thử phẩm chất những giống lúa này. Phương pháp nông dân tham gia đánh giá giống giúp sự tiếp nhận các giống lúa mới có gen chống chịu ngập sẽ tốt hơn. Có sự tương quan trung bình giữa nam và nữ nông dân về sự chọn các đặc tính giống, chứng tỏ rằng có sự tương đồng của họ về chọn giống lúa. Sự chọn giống giữa nông dân và cán bộ nghiên cứu cũng có sự tương đồng. Những đặc tính giống nông dân ưa thích gồm có kháng sâu bệnh, năng suất cao, cứng cây chống đỗ ngã, ngon cơm, chịu phèn, cây con khỏe sau khi gieo, thời gian sinh trưởng ngắn, nẩy chồi nhiều, cao cây, và yêu cầu ít phân bón. Nghiên cứu này cho thấy quan điểm sự tham gia chọn giống đảm bảo sự chọn giống đúng đối tượng nông dân và vùng lúa góp phần phát triển giống và khuyến nông nhanh giống lúa chống chịu ngập.