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Participatory Variety Selection (PVS) to Assess Farmer Preferences of Traditional Glutinous Rice Varieties in The Lao PDR

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Abstract

The trial on Participatory Variety Selection (PVS) was conducted on 9 sites in wet season 2004. Twenty-two traditional varieties, with diverse agronomic characteristics were used to grow in farmers' fields.

The trials conducted in the first year allow us to redefine growing conditions of target rice growing areas and could be used to select the suitable location to evaluate traditional glutinous varieties (TVs). Sites selected for conducting the trials covered a wide range of main rice planting areas in all three regions: northern, central and southern regions with 3 sites in each region.

Participatory variety selection (PVS) approach, in which trials were conducted, is useful in allowing researchers to interact and closely work with farmers and helps breeders understand better about variability of the growing conditions in target areas and responses of cultivars under both inside and outside their origin. It was clear that diverse locations with different topography had effects during the growing season across sites. Higher elevation and lower temperature caused delay in harvesting time in the north. However, the relationships between agronomic characteristics: grain yield, maturity, plant height under trial and preference index of gender was low correlated for all regions.

Performance of TVs in response to locations influenced farmers' acceptance or rejection of those varieties. It was apparent that high yield was a preference character voted by farmers in most sites. Both men and women were more preferred Ikhao, Homdo, Leuathet and Makhing because high yield, large grain and early to medium maturity. Ikhao, Makhing and Homdo varieties were preferred in each region and Yuando was preferred across regions. Some varieties showed specific adaptation to specific regions such as: Yuando is well adapted to the north, TDK4 has good adaptation to central area while Leuathet, Takhiet and Ikhao are well adapted to the south.

Cultivars that produced many tillers, big panicles, more grains per panicle, compact panicle and large grain were considered as the farmers' preference for rainfed lowland rice characters. However, preferred agronomic characters that could be defined, as "farmer ideal types" need to be investigated further.

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Introduction

Rice is a very important crop for people in Laos. More than ten years ago, high yielding rice varieties were introduced to farmers all over Laos. Many farmers accepted the new varieties and abandoned local varieties. However, some farmers in the country still conserve their traditional glutinous rice especially in the rainfed lowland rice environment. These varieties are generally high yielding in some specific locations, but often lower yielding in other areas. Hence, until today, these farmers are growing a great number of traditional varieties. This contributes to the conservation not only of the varieties but indigenous knowledge as well (Appa Rao, 1997).

Development of breeding varieties for the regions, by the national breeding program, has progressed slowly. This is due to limited opportunity to evaluate breeding lines/varieties and select varieties suitable for a range of growing environments. Some farmers in the regions prefer some photoperiod-sensitive varieties for consumption and sale (Lao-IRRI, 1999). These traditional varieties have long been used in the regions and also have been well known as high yielding which good eating grain quality and they are still popular.

Farmers play a key role in preventing plant genetic erosion. The best way to conserve and develop food crop diversity for the food security of the community and the world is to enjoin farmers' participation in these activities as much as possible. It is important for researchers and development institutes to learn how to work with farmers. The interaction with farmers and other sectors is equally necessary. It is also helpful for the breeding program in the country to meet the goal (CBDC, 2001). The main purpose of participatory variety selection (PVS) is to provide information about variety performance and acceptability. Other mechanisms (e.g. demonstration) are more appropriate for variety dissemination (Atlin, 2001).

Participatory variety selection approach was used for the study to evaluate traditional varieties under a wide range of growing conditions in target areas of farmers' fields, to provide opportunity to farmers to access new varieties and enhance production using diverse varieties, and to study farmers' preference on agronomic characteristics on rainfed lowland rice.

Material and Methods

The trial on "Participatory Variety Selection" was conducted on 9 sites: Luang Namtha, Xiengkhouang, Sayabouly, Vientiane municipality, Khammouan, Savannakhet, Salavanh, Attapeu and Champasak, covering three agricultural regions: northern, central and southern regions with 3 sites in each region in wet season 2004. Twenty-two traditional

varieties with diverse agronomic characteristics were selected from Lao Rice Germplasm (LRG) bank for used in this study. The trials were laid out in Randomized Complete Block (RCB) design with four replications and a plot size of 1m x 5m. Twenty to thirty farmers comprise of half men and women were involved for participating and selecting varieties.

Cooperation of farmers

After selecting experimental sites, farmers in each location were invited to attend the meeting in order to ask them to serve as cooperative farmers for PVS. The meeting was conducted at nearby the site. In each location, a researcher from a research station explained the objectives and details of the activities that would be conducted in their area.

Data collection

The researchers had to visit the experiments a few times before harvesting to collect data with randomly. The physiological maturity from seeding to 50% flowering plus 30 days, number of panicle per hill with average 10 hills, and plant height measured from ground to the top of panicle of 10 plants per plot before harvesting about 5–10 days and grain yields were recorded after adjusted to 14% moisture content. On the other hand, damage from insect pests and other problems: drought, flood, weed and etc have been recorded. After that researcher interviewed the participating farmers on cultural practices, occurrence of biotic and abiotic stresses and performance of test varieties comparing with existing variety that farmers used.

Evaluation of farmers' preference in agronomic characters of test varieties

Preparation of ballots

Ballots were used for voting (Fig. 1). Smiling and sad faces made of paper were prepared for voting. Smiling faces represented most preference (satisfactory) and sad faces represented least preference (disappointment) in varieties.

Fig. 1 Ballots used for voting of most preference (smiling face) and least preference (sad face) in characteristics of paddy rice

Farmer appointment and field preparation

A researcher contacted a head of village before conducting the trial for coordination with farmers. The objective, process and period of conducting and expected number of farmers, men and women to attend was discussed with the head of the village.

Four to five researchers were required for organizing the evaluation because there were a large number of farmers and all process needed to be well prepared. Only one best replication of the trial was chosen for evaluation. The name of the rice variety was not shown and only plot number was labeled in front of each plot to prevent farmer bias of known varieties. A paper bag was hung on a stake installed in front of each plot for receiving ballots from farmers during voting. Near the field, a shelter, a cottage or a tree shade was prepared for gathering farmers for focus group discussion after voting and sharing the opinion.

Voting

Farmers were asked to express their preferences of varieties by "voting", for the varieties in the trial, the one that they preferred the most and the least. Each farmer was given 3 ballots of smiling faces and another 3 ballots of sad faces for voting. However, farmers will be asked to observe and consider performance of variety in each plot then put one ballot (one variety per one vote of smiling or sad face) in a bag that hung on the stake installed in front of each plot. Among those 22 varieties, they could vote up to 3 for the most preferred and 3 for the least preferred. However, if farmers wanted to vote for only one or two preferred or non-preferred varieties (not all three), they could do so.

After voting farmers got together under a shelter, cottage or a tree shade and were served with cold drinks and some snacks while research staffs were counting the ballots. Results of voting were presented to farmers and discussion was begun.

Focus group discussion conducted after voting

At the beginning, farmers were asked to give general information about the previous and current varieties used and constraints for production, e.g. drought, flood, disease and insect pests incidence. When farmers paid attention to the discussion with researchers and among themselves, researchers started discussion on characteristics that are the most and the least preferred. Farmers were asked to explain why they liked or disliked those varieties. All characters that were mentioned during discussion were listed on a paper chart standing in front of the farmers and a few other researchers took notes.

Preference index (P)

Data obtained from the focus group discussion of farmers use for analysis of prefer plant characters of rainfed lowland rice and (P) was calculated for each variety as: P = (number of positive ballots-number of negative ballots)/(total number of positive and negative ballots cast at the site).

Results and Discussions

Participatory variety selection for traditional glutinous varieties (TVs) in the nine locations

Twenty-two TVs have been evaluated at nine locations during wet season 2004 (Table 1). Statistical significant differences among varieties in yield, maturity, panicles per hill and plant height were observed. Mean grain yield was 2944 kg/ha. Yields performance indicated 10 varieties had higher yields than 3000 kg/ha. Only Ikhao variety gave the highest yield 3379 kg/ha more than improved check variety TDK4 with 3258 kg/ha and the lowest yield was from Kainoy with only 2235 kg/ha. The days to maturity ranged from 129 days earliest maturity (Homthong) to 163 days latest maturity (Dokphao) among TVs, which are acceptable for rainfed lowland rice environment for different toposequence positions. The number of panicles per hill varied from 4.7-6.8 panicles per hill, which was quite suitable for traditional varieties and plant height ranged from 114 cm (TDK4) to 152 cm (Pouangmalay). This indicated that all traditional varieties are tall plant type. Moreover, preference scores varied from variety to variety. There were some varieties got high preference score: Ikhao, Homdo, Leuathet, Makhing, Yuando, Meuangnga and Takhiet with preference score 0.907, 0.469, 0.449, 0.424, 0.355, 0.344 and 0.308, respectively from both men and women. This revealed that these varieties showed more acceptability than the rests, because giving high yield, tall plant, good tillering and early to medium maturity. These varieties might have better adaptation than others. Among these TVs, Khaola got the lowest preference score of -0.730, followed by Homphama with -0.543 and Kainoy with -0.500, because of non-uniform plant type and less grains per panicle which indicating that these varieties showed the least satisfaction of agronomic characteristics to many farmers.

The desired characters from both men and women were long panicle and good tillering. However, men give more emphasis on full grain and good adaptation to any soil type, while the women are more concerned with grain yield, strong culm and grain quality as large/long seeds. The results of the study revealed that men had more preference for Makhing and Ikhao, while Khaola was the least preference (Fig. 2). While women had more preference for Ikhao and TDK4, but the least preference for Kainoy (Table 1). A correlation indicating that there was correlated between women and grain yields (Table 2).

Table 1 Agronomic characteristics and grain yield of 22 traditional glutinous varieties

Variety	Yield (kg/ha)	Maturity (days)	Plant height (cm)	Panicle /hill	Men score	Women score	Total score
Leuathet	2984	152	142	5.3	0.202	0.248	0.449
Homdo	2878	139	138	6.4	0.185	0.285	0.469
Yuando	2979	140	133	5.4	0.118	0.238	0.355
Homphama	2868	136	135	5.6	−0.264	−0.279	−0.543
Meuangnga	3126	156	148	5.6	0.169	0.174	0.344
Takhiet	3105	153	149	5.4	0.193	0.115	0.308
Ikhao	3379	147	138	5.8	0.370	0.537	0.907
Khaonong	2733	137	135	4.7	−0.055	−0.123	−0.178
Bongleuang	3171	157	143	5.9	−0.166	−0.255	−0.420
Khaola	3126	158	141	5.8	−0.404	−0.326	−0.730
Khaomeuay	3080	155	147	6.1	0.048	−0.048	0.000
Kainoy	2235	135	124	5.2	−0.193	−0.307	−0.500
Homnangnuan	3159	159	136	5.9	−0.011	−0.076	−0.087
Dokphao	2402	163	140	5.3	−0.168	−0.220	−0.389
Dokmay	2706	149	140	5.8	−0.128	0.003	−0.125
Phouangmalay	3256	155	152	5.8	0.178	0.120	0.298
TDK4	3258	157	114	6.0	−0.187	0.374	0.188
Iloup	2787	161	145	5.2	−0.154	−0.074	−0.228
Makhing	2963	155	137	5.4	0.507	−0.083	0.424
Homthong	2808	129	137	5.8	0.033	0.086	0.119
Homphouthai	2557	161	146	5.3	0.079	0.013	0.091
Homdang	3206	137	138	6.8	−0.022	0.020	−0.002
Mean	2944	150	139	5.7			
F-test	**	**	**	**			
LSD5%	526	2.8	7.6	1			

Mat = Maturity (days), Pht = Plant height, Pn = Panicles/hill,

Table 2 Correlation of agronomic characteristics and farmers preference

	Yields (kg/ha)	Mat (days)	Pht (cm)	Pn	Men
Yields (kg/ha)					
Mat (days)	0.18				
Pht (cm)	0.16	0.37			
Pn	0.52*	−0.11	−0.03		
Men	0.30	−0.01	0.29	−0.01	
Women	0.49*	−0.06	−0.07	0.23	0.62**

Mat = Maturity (days), Pht = Plant height, Pn = Panicles/hill, men = Preference of men, women = Preference of women.

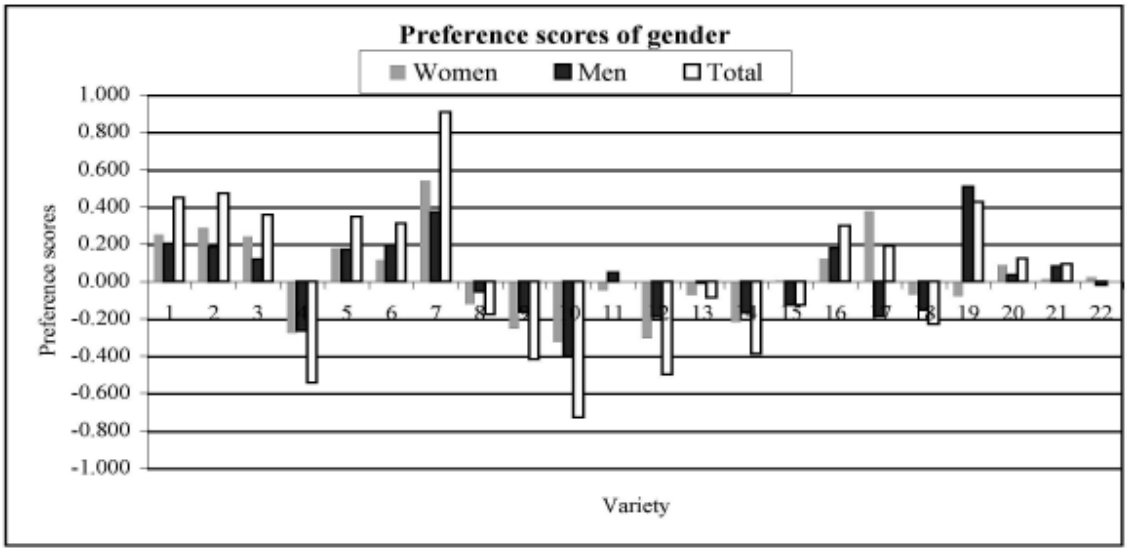

Fig. 2 Farmers' preference between men and women

Farmers preference score among regions

The results of farmers' preference score over regions: northern, central and southern regions were non-significant (Table 3) but there was a significant difference between variety average over regions and also variety by region interaction. The results indicated Ikhao, Makhing and Homdo varieties were preferred in each region and Yuando preferred across regions. On the other hand, preference score had a very high error variance from region to region because of different topography among three agricultural regions leading to crop growth stage difference and harvesting time earlier in the south and later in the north.

The farmers' preference among three regions (Table 4) showed preference score over three regions. Also Ikhao showed the best performance, followed by Homdo, Leuathet and Makhing. This indicated that these four varieties might have wider adaptation than others and more acceptability in almost all regions outside their origin. On the other hand, some varieties showed specific adaptation to specific regions such as: Yuando well adapted to north, TDK4 has good adaptation to central area and Leuathet, Takhiet and Ikhao are well adapted to the south.

Table 3 Preference score of 22 traditional glutinous varieties across three regions

Source of variation	Df	F	Pr. > F
Region (R)	2	0.45ns	0.6363
Variety (V)	21	2.88**	0.0001
Region (R) * variety	42	1.58*	0.0272
Source of variation	**Variance component Estimate**		
Loc (L)	0		
Var (V)	0.0002987		
Error	0.0017362		

Table 4 Preference score among three regions

Variety	Farmers' Preference (P)			
	North	Central	South	Total
Leuathet	0.082	−0.016	0.384	0.449
Homdo	0.145	0.167	0.157	0.469
Yuando	0.349	0.083	−0.077	0.355
Homphama	0.053	−0.241	−0.355	−0.543
Meuangnga	0.035	0.146	0.162	0.344
Takhiet	0.046	−0.019	0.281	0.308
Ikhao	0.298	0.285	0.325	0.907
Khaonong	0.160	−0.333	−0.005	−0.178
Bongleuang	−0.263	0.079	−0.236	−0.420
Khaola	−0.151	−0.400	−0.179	−0.730
Khaomeuay	0.093	−0.021	−0.072	0.000
Kainoy	−0.143	−0.285	−0.072	−0.500
Homnangnuan	−0.123	0.012	0.024	−0.087
Dokphao	0.007	−0.164	−0.231	−0.389
Dokmay	0.028	0.021	−0.174	−0.125
Phouangmalay	0.000	0.150	0.148	0.298
TDK4	−0.159	0.653	−0.306	0.188
Iloup	−0.045	−0.058	−0.125	−0.228
Makhing	0.077	0.125	0.222	0.424
Homthong	0.133	−0.056	0.042	0.119
Homphouthai	0.117	0.021	−0.046	0.091
Homdang	0.015	−0.148	0.131	−0.002

Chi-square tests of proportion base on preference score between men and women and difference among regions.

Chi-square tests for homogeneity were used to test for differences among tested varieties based on preference scores between men and women (Table 5). There were two varieties: TDK4 and Makhing which appeared to be significant different at 0.01 and 0.05 levels, respectively. This revealed that these two varieties have different preference scores of gender between men and women.

For comparisons among varieties over three regions: north, central and south based on preference scores there were perceived large differences among these varieties. There were eight varieties: Leuathet, Yuando, Homphama, Meuangnga, Khaonong, Bongleuang, TDK4 and Homdang with significant differences at 0.01 level, while there were seven varieties: Ikhao, Khaomeuay, Kainoy, Dokphao, Dokmay, Homthong and Homphuthai which showed significant difference at 0.05 level. This result indicated a high difference of preference scores among regions and specific preference within the regions. For instance, TDK4 had high preference scores in central but low scores in both northern and southern regions.

Table 5 Preference Chi-square of 22 traditional glutinous varieties for gender and regions

Variety	Chi-square (λ^2) for farmers' preference (P)	
	Gender (men and women)	Regions (North, Central and South)
Leuathet	0.24ns	12.6**
Homdo	0.00ns	5.6ns
Yuando	0.01ns	19.1**
Homphama	0.23ns	20.1**
Meuangnga	0.63ns	3.4ns
Takhiet	0.34ns	12.5**
Ikhao	0.02ns	6.9*
Khaonong	0.00ns	20.8**
Bongleuang	0.67ns	16.5**
Khaola	2.85ns	2.2ns
Khaomeuay	1.27ns	5.9*
Kainoy	0.06ns	6.8*
Homnangnuan	0.45ns	2.0ns
Dokphao	0.06ns	9.4*
Dokmay	2.54ns	7.8*
Phouangmalay	0.78ns	0
TDK4	10.79**	48.9**
Iloup	0.83ns	2.8ns
Makhing	7.02*	1.9ns
Homthong	0.00ns	6.0*
Homphouthai	0.82ns	8.2*
Homdang	0.62ns	11.8**

P = Preference index

Farmers' preference in agronomic characteristics

A list of preferred characters of TVs is given in Table 6. The result showed that there were four varieties: Ikhao, Homdo, Leuathet and Makhing had more preference than others, because these TVs had big panicle, full grain, strong stem, large grain, uniform, medium maturity, more tillers, high yields. While the other three varieties: Khaola, Homphama and Kainoy had less preference due to late maturity, small seed, small panicle, non-uniform, few tillers, thin stem, low yields. large grain, big panicle, strong stem, uniform and medium maturity are the most desired characters. However, the important character indicated by farmers might be the character that would adapt to the rainfed lowland conditions especially the one that gave high grain yield.

Preferred plant characteristics of rainfed lowland traditional rice varieties

The preference characters of rainfed lowland rice is given in Fig. 3 and 4. High yield was the most preferred character followed by good eating quality, appropriate maturity, big panicle, strong culm and good tiller ability respectively. Another five characters following those six characters were dense grains within a panicle; resistance to insect pests; tall plant; large grain and even flowering. At the same time, not many hairs, many filled grains and long grain were lesser priorities. It is considered that a high yielding ability was the most important agronomic character to accept TVs. The good tillering ability with big and compact panicles may contribute to the yield component, while insect pests resistance, strong culms (no lodging) would mediate against yield reduction. Several studies indicated that cultivars with tall plant, few tillers with big panicles could adapt to rainfed lowland conditions better than cultivars with short plant, many tillers with relatively smaller panicle size (like some irrigated rice). Expression of farmers' knowledge for the preferred plant characters may be the result of their long learning experience of growing rice under rainfed lowland conditions.

Aside from characters association with adaptability to the growing environment, some characters that farmers mentioned are considered to result from constraints for rice production in the region that farmers experienced. A list of non-preferred characters of TVs under rainfed lowland rice is given in Fig. 3. Low yield was the most not satisfied character followed by poor eating quality; lodging; small grain; short panicle; non-uniform plant and flowering; dwarf; too early and too late maturity, susceptible to insect pests and weak stem respectively. However, these not satisfied agronomic characters may lead to reduce rice yields.

Table 6 Preferred plant characteristics of rainfed lowland traditional glutinous varieties that were mentioned by groups of farmers in wet season 2004

Cultivar name	Sex	Preference characteristics			
		MP		LP	
		No of votes	%	No of votes	%
Homdo	Men	16	36	4	9
	Women	20	44	5	11
	Total	36	80	9	20
		Positive characteristics mentioned by farmers			
		Large grain, big panicle, full grain, strong stem, uniform, early maturity, more tillers			
Ikhao	Men	28	41	4	6
	Women	32	46	5	7
	Total	60	87	9	13
		Positive characteristics mentioned by farmers			
		Big panicle, full grain, strong stem, large grain, uniform, medium maturity, more tillers, high yields			
Leuathet	Men	25	43	9	16
	Women	19	33	5	9
	Total	44	76	14	24
		Positive characteristics mentioned by farmers			
		Big panicle, full grain, strong stem, large grain, uniform, medium maturity, high yields			
Makhing	Men	43	55	11	14
	Women	12	15	12	15
	Total	55	71	23	29
		Positive characteristics mentioned by farmers			
		Big panicle, full grain, strong stem, large grain, uniform, medium maturity, more tillers, high yields			
		Not Preference Characteristics			
Homphama	Men	5	9	23	43
	Women	6	11	20	37
	Total	11	20	43	80
		Negative characteristics mentioned by farmers			
		Small panicle, weak stem, few tillers, low yields, non-uniform			
Khaola	Men	1	2	24	47
	Women	5	10	21	41
	Total	6	12	45	88
		Negative characteristics mentioned by farmers			
		Late maturity, lodging, few tillers, more empty seed			
Kainoy	Men	2	5	12	32
	Women	4	11	19	51
	Total	6	16	31	84
		Negative characteristics mentioned by farmers			
		Small grain, small panicle, non-uniform, few tillers, thin stem, low yields			

Conclusion

The trials conducted in the first year allow us to redefine growing conditions of target rice growing areas and could be used to select the suitable location evaluate TVs. Sites selected for conducting the trials covered a wide range of main rice planting areas in all three regions: northern, central and southern regions with 3 sites in each region.

Participatory variety selection (PVS) approach, in which the trials were conducted, is useful in allowing researchers to interact and closely work with farmers. The approach helps the breeders and researchers to understand better about variability of the growing conditions in target areas and responses of cultivars under those inside and outside their origin. It was clear that diverse locations with different topography had effects during growing season across sites. Higher elevation and lower temperature cause delay in harvesting time in the north and lower elevation, higher temperature with good rainfall promoted earlier maturing cultivars in central and southern regions. However, the relationships between agronomic characteristics: grain yield, maturity, plant height, number of panicles per hill under trial and preference index of gender had correlated with yields.

Performance of TVs in response to locations influenced farmers to accept or reject those varieties. It was apparent that high yield was a preference character voted by farmers in most sites.

Both men and women had more preference to Ikhao, Homdo, leuathet and Makhing due to high yield, large grain and early to medium maturity. Ikhao, Makhing and Homdo varieties were preferred in each region and Yuando preferred across regions.

Some varieties showed specific adaptation to specific regions such as: Yuando well adapted to north, TDK4 has good adaptation to central area while Leuathet, Takhiet and Ikhao are well adapted to the south.

High yielding cultivars that produced many tillers, big panicles, many grains per panicles, compact panicle and large grain were considered as the farmers' preference for rainfed lowland rice characters. However, preferred agronomic characters that could be defined, as "farmer ideal types" have been equivocal under this study and need to be investigated further.

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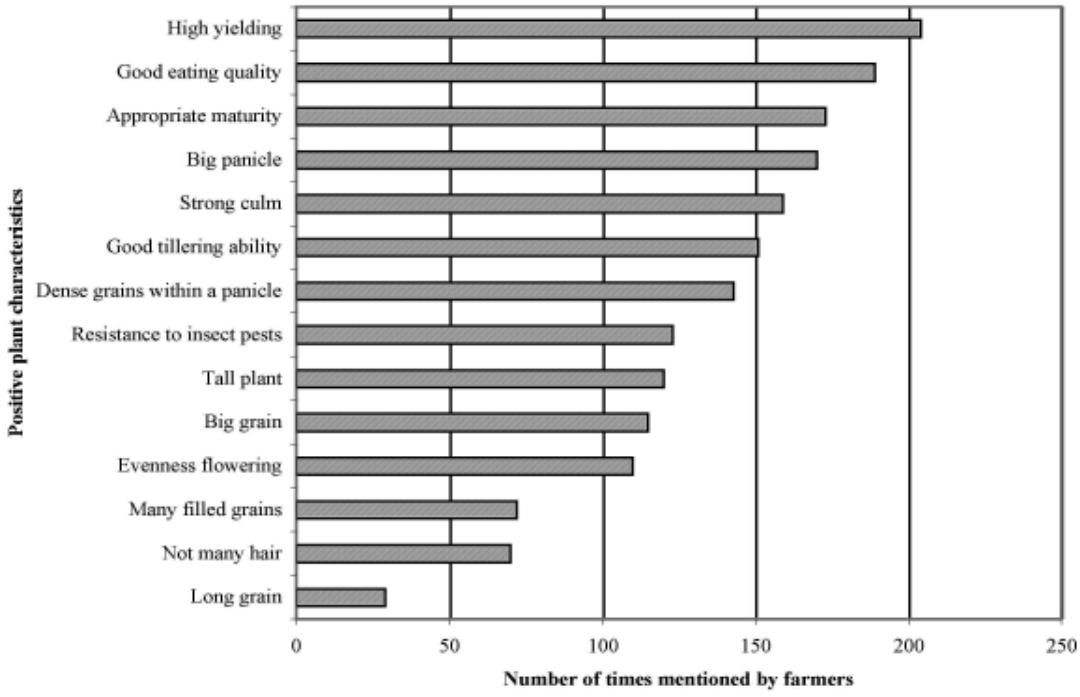

Fig. 3 Positive plant characteristics voting by the farmers

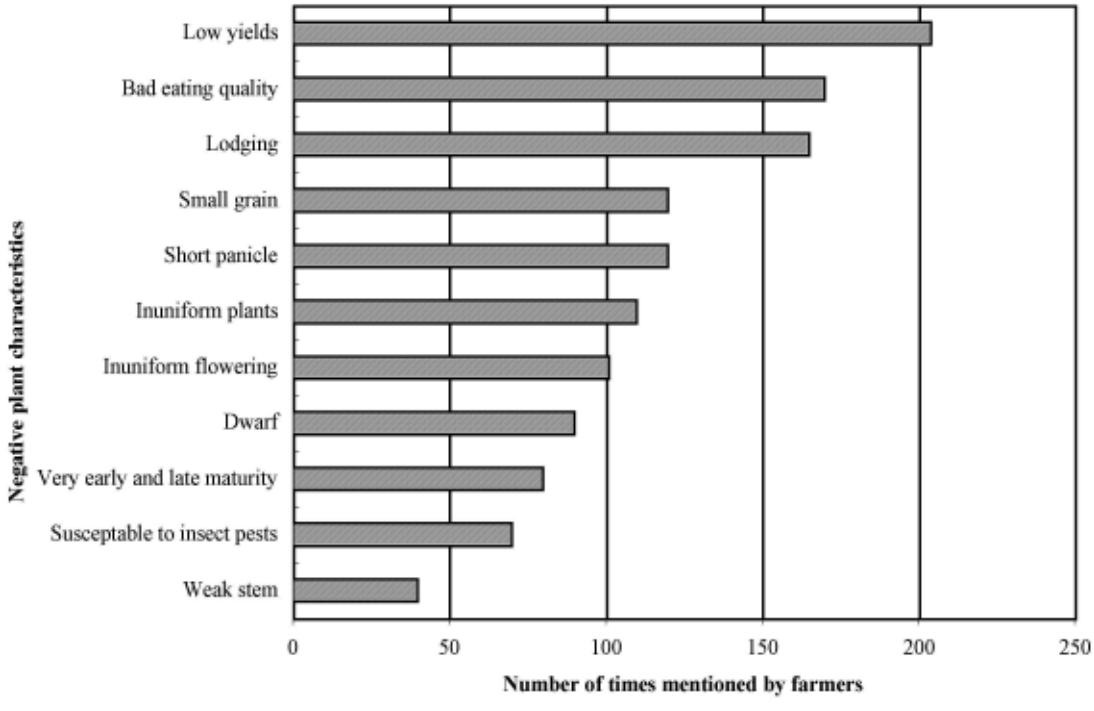

Fig. 4 Negative plant characteristics voting by the farmers

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