Participatory varietal selection: Lessons learned from the Lao upland programme

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Abstract

Several thousand traditional upland rice varieties have been collected in Laos. Between 1992 and 2000, approximately 2000 of these were evaluated for grain yield and other agronomic characteristics in researcher-managed trials in northern Laos, in an effort to identify high-yielding traditional varieties for dissemination to upland farmers. A few of the tested varieties were given to farmers to evaluate in collaboration with district extension officers before 2001, but data were returned in only 6% of the on-farm trials. In 2001, a new participatory varietal selection (PVS) programme was designed and implemented to obtain information about farmer preference and on-farm performance of the upland varieties, and to increase the efficiency of the screening effort. In the first stage, on-farm PVS was conducted with 32 farmers in five provinces. Farmers evaluated eight early or eight mid-duration varieties selected by researchers in the earlier agronomic testing programme. Preference data were successfully obtained from 84% of the farms and yield data from 63%, a 10-fold increase in the on-farm trial success rate over the previous programme. Farmers strongly preferred early-maturing, large-seeded varieties with large panicles and strong stems, and disliked varieties with few tillers or tillers that ripened non-uniformly. These criteria will be incorporated into the initial stages of varietal screening in the future. The correlation between variety means over farms for grain yield and preference rating was 0.82 in the medium maturity trial and 0.54 in the early trial. Occasionally, high-yielding cultivars were not preferred, but the lowest-yielding cultivars were never preferred, indicating that agronomic selection for grain yield helps to select varieties farmers prefer. A farmer-preferred, early-maturing variety (Nok) that significantly outyielded the local checks was identified. This and five other lines are being evaluated in a scaled-up PVS programme in 2002.

Introduction

Between 1992 and 2000 more than 13,000 traditional rice samples (representing over 3000 different varieties) were collected from Laos. More than 7,300 of these samples were upland rice varieties. Using this collection, a system was set up to identify superior varieties for wide release. While germplasm from breeding programmes are also evaluated, the focus is on the traditional varieties. The rationale behind this is that the Lao prefer glutinous rice and there are relatively few improved glutinous varieties.

The process of evaluation involves four steps. The Huay Khot Research Station in Luang Prabang province annually receives a new set of 300 accessions from the Lao genebank, which are evaluated on-station in an observational nursery (OBN-1). From this, 20-30% of the varieties are selected for a second observation nursery (OBN-2). A limited number of varieties (8-16) are selected from the OBN-2 for multi-location yield trials (MLYT). Variety evaluation in these first three stages is based primarily on yield and duration (preference for early maturing varieties). Varieties selected from these are then evaluated on-farm. Between 1992 and 2000, over 2000 varieties were evaluated through this system and 27 varieties were selected for on-farm evaluation. For on-farm evaluation, varieties (typically 60 g/variety/farmer) were sent to district officers, who identified cooperating farmers. The success rate in this final stage was poor. Between 1994 and 2000, 235 farmers were involved in on-farm evaluation. However, data were only collected from 15 farmers (6%). As of 2001, there were no varieties that can be recommended for the uplands, due mainly to limited data on farmer preference and performance under farmer management.

In initiating a PVS programme there were two broad objectives. First, there was a need to accelerate the evaluation of upland material. Continuing at the current rate (about 300 varieties entering the evaluation process each year), it will take over 20

years to evaluate all the upland varieties. Identifying and using farmer-preferred characteristics, it is possible to rapidly screen varieties using passport data (passport data are available for all rice samples held in the genebank) and in the OBN-1. Second, it was recognized that changes needed to take place in the final stage of evaluation (on-farm testing). While the programme was able to collect agronomic data from the first three stages of the evaluation process, the final stage has produced no information on farmer preference.

To achieve these objectives, activities in this first year of PVS involved:

- Training of researchers and district officers in participatory research methods;
- Evaluating varieties on-farm using participatory research methods;
- Identifying characteristics farmers prefer in their rice varieties.

Materials and Methods

On-farm PVS was conducted with 32 farmers in five provinces: Luang Prabang (10 farmers), Oudomsay (six farmers), Luang Namtha (four farmers), Sayaboury (six farmers) and Xieng Khouang (six farmers). Seed availability limited the number of farmers able to evaluate the 16 glutinous upland rice varieties included in the trials. Twelve varieties were selected from the 2001 multi-location yield trials and four from previous trials (Vieng, Hom, Dam and Makthoua). These varieties were divided in two groups depending on their duration (Table 1)

For the 2001 PVS trials, participating farmers were given one set (early or medium) of eight varieties (110 g per variety). This was enough to plant an area of 15 m2 of each variety. Farmers were given assistance with plot layout and planting but managed the plots according to their normal practices.

Between flowering and maturity, researchers visited each farmer and conducted a Preference Analysis (PA). In the PA the farmers were asked to rank each variety using seeds, placing more seeds for varieties they liked.They were then asked to indicate the positive and negative characteristics of the varieties. Finally, they were asked which varieties they would continue to evaluate next year on their own. At harvest, the researchers and farmers harvested each plot for grain yield.

Analysis

Of the 32 farmers evaluating varieties, 27 participated in the PA and we were able to collect yield data from 20. Yield data from four of the sites where the data was collected were not used in the analysis because of poor plot layout.

Individual farmer variety rankings were standardized across farmers by expressing the ratings (seed placed by each farmer on the board) as a proportion of the total number of seed applied to the board by each farmer? The ratings were further standardized to a mean of 0 and SD of 1 for each farmer. Least-squares means were estimated using PROC MIXED METHOD=REML in SAS, with varieties considered fixed, and farms random effects. Correlations between measured grain yield and farmer preference ratings were estimated for those farms for which both types of data were collected.

Results and Discussion

General

Compared to previous years, the 2001 on-farm trials were very successful. PA data were collected from 84% of the farmers and yield data from 63%. Good success can be at least partially attributed to timely training (particularly in participatory research methodology) and continuous follow-up during the course of the season.

In some cases, the PA could not be conducted due to early crop damage by livestock. Yield data could not be collected from some farmers due to damage by livestock, wild pigs or rats. These are factors that the researchers can do little about. However, at four sites, PA and yield data were collected, but due to poor plot layout, the data could not be used in the analysis. Related to this, some of the trials were in fields where the local variety (used as

Table 1. Varieties and Accession numbers evaluated during the 2001 PVS trials

Early Maturing		Medium Maturing	
Accession no.	**Variety name**	**Accession no.**	**Variety name**
LG-7347	Taa roon	LG-7051	Do hom
LG-6911	Deng said	LG-6432	Mak hine
LG-7771	Kou yongke	LG-7023	Da cheung
LG-6499	Nok	LG-7084	Paneur
LG-	Vieng	LG-6655	Lebmeu
LG-	Hom	LG-1724	Dam
LG-6905	Sang	LG-6593	Sangon
LG-6501	Deng	LG-2387	Makthoua

the control) had longer growth duration than those being evaluated. This resulted in worse than normal pest damage. In future, there will need to be training in these areas, and simpler designs involving fewer varieties will be used

Preference Analysis: preferred plant characteristics

During the PA, farmers were asked to identify reasons why they liked or did not like particular varieties. These reasons were summarized from all the PAs and are given in Figure 1. Large panicles, big seed and strong stems were the most commonly referred to positive characteristics. In contrast, farmers did not like varieties that produced few tillers, had short panicles or had panicles that matured non-uniformly. All the varieties evaluated were of early and medium duration, therefore, preference for early duration did not stand out prominently in this PA. However, early maturaton was mentioned as a positive character and late maturation as a negative character. Earlier research had identified farmer preference for early- and medium-maturing varieties, and therefore, only such varieties were included in the on-farm evaluation.

Using these criteria, varieties can now be eliminated early in the evaluation process, saving time and limited resources. For example, passport data (including data for some of these characteristics) exist on most varieties in the collection. Using this database some varieties could easily be eliminated from the evaluation process. Also, in the OBN-1, variety scoring should include these characteristics, to ensure that varieties selected for further testing will not be rejected by farmers for reasons that are already obvious.

Grain yields and farmer variety ranking

In the early trial the highest grain yield (GY) was 2.14 t ha^{-1} (Nok). This was significantly higher than the average of the local early-maturing varieties which yielded 1.5 t ha^{-1}. In the medium trial the highest yield was 1.94 t ha^{-1} (Makthoua) which was similar to the average yield of the local varieties (1.82 t ha^{-1}).

An analysis of data for only those farmers from whom both yield and preference data were obtained showed significant differences in yield and preference in the medium maturity group, but not in the early group (yield, P=0.06). Yields and farmer preference ratings (PR) (standardized) were associated. The correlation between variety means over farms for GY and PR was 0.82 in the medium maturity trial and 0.54 in the early trial. Occasionally, high-yielding cultivars were not preferred, but the lowest-yielding cultivars were never preferred. This indicates that agronomic selection for grain yield helps to select varieties farmers prefer.

A test of cultivar by province interaction was conducted, using the within-province cultivar x farmer interaction as an error term. There was no detectable cultivar x province interaction for GY. A

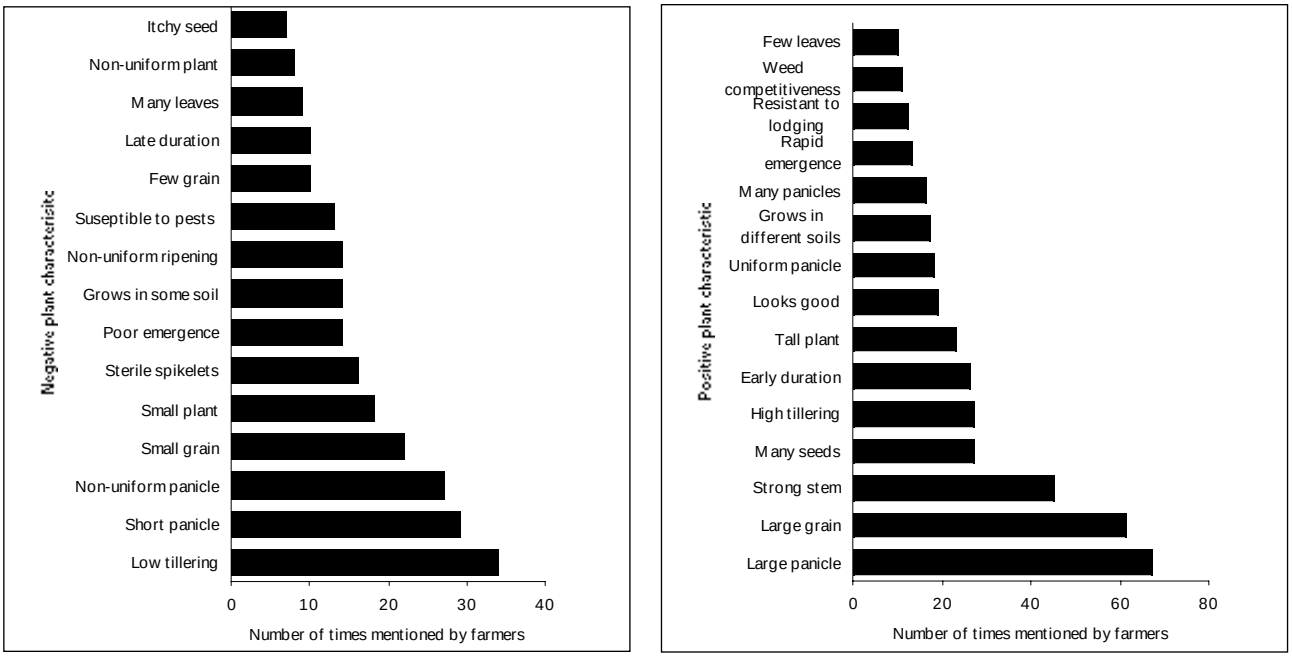

Figure 1. Results from the preference analysis (PA) summarizing positive and negative plant characteristics most mentioned by farmers. Twenty-seven farmers participated in the PA. The number of times a characteristic is mentioned can be more than 27 because farmers were evaluating eight varieties.

significant interaction was observed for PR in the early cultivar set; the cultivar Kouyonke was strongly preferred in Luang Prabang, but had a very low preference score in Sayabouli. The reason for this rank reversal is not clear. Certainly, one may expect interactions between cultivars and different farmers, ethnic groups, or environments. However a larger number of farmers must be surveyed for such an analysis to be reliable.

What next?

Based on farmers' preferences and grain yield, Taa roon, Nok, Do Hom, Makhine soung, Dam and Makthoua were selected for further evaluation in 2002. Seed of these varieties are being multiplied during the 2002 dry season. A Mother-Baby design (Annexe 1) will be employed in the 2002 analysis.

One Mother trial will be placed in each village, which will permit many farmers to evaluate varieties side by side. Baby trials will consist of one farmer receiving one variety to compare with their variety. In each village, we anticipate three or more farmers evaluating each variety (a total of 18 or more farmers per village). The number of villages depends on the success of the seed multiplication. Yield data will be collected from the Mother trial. In the Baby trials, farmers will be asked to compare the two varieties, as well as providing information collected on growing conditions, soil type, etc. This information can be gathered during and after (provide some comparison of grain quality) the growing season.

Farmers need to be involved earlier in the selection process. We have already indicated that results from the PA could be used to help screen out varieties early in the evaluation process. However, farmers could also be involved in the MLYT. This was done in 2001 but results are not yet available. Farmer involvement at this stage requires a different methodology.

Lessons learned

- Compared to earlier on-farm work the success of on-farm evaluation using participatory methods was very good.
- In the future, more training emphasis needs to placed on good plot layout if a number of varieties are to be evaluated in a single location.
- Better care needs to be taken in working with farmers, so that the duration of the varieties being tested matches the duration of the local check variety.
- Too many varieties were evaluated with each farmer. This resulted in several problems: (1) farmers could not remember variety names, (2) the PA took too long and (3) it was easy for farmers and researchers to get varieties mixed up. Based on our experiences, no more than five varieties should be evaluated with any one farmer. When evaluating many varieties a simple question could be, "What varieties will you plan to further evaluate next year?" Farmers were always quick to identify such varieties. These would naturally be the one the farmer is most interested in.
- In future evaluations it would be good to gather additional information from the farmer related to the environment (such as, soil type, soil colour, drought occurrence [if so, early middle or late season]). This would allow us to test interactions between cultivar and environment.
- In future evaluations we need to ask farmers to evaluate post-harvest

Table 2. Average grain yields and ranking in 2001. Varieties in bold those selected for evaluation in 2002.

Early varieties			Medium varieties			
Variety	**Grain yield (t ha^{-1})**	**Standardized farmer preference***	**Variety**	**Grain yield (t ha^{-1})**		**Standardized farmer preference***
Nok	**2.14**	**0.53**	**Makthoua**	**1.94**	**a**	**0.46**
Hom	2.08	-0.44	**Mak hine**	**1.75**	**ab**	**0.62**
Taa roon	**1.98**	**0.60**	**Do hom**	**1.72**	**ab**	**0.49**
Kouyongke	1.88	0.02	**Dam**	**1.55**	**bc**	**0.39**
Vieng	1.86	-0.16	Peek	1.48	bc	-0.70
Deng said	1.67	0.04	Da cheung	1.33	c	-0.11
Deng	1.62	0.06	Sangon	1.31	c	-0.41
Sang	1.34	-0.65	Lebmeu	1.19	c	-0.76
LSD	ns	ns		0.39		0.83

* Farmer rank is standardized so that the mean is 0.0

characteristics of the rice, such as threshability, milling quality and taste. This was not done this year due to the limited amount of seed each farmer received.

- More seed (at least 0.5 kg and preferably 1 kg) needs to be provided to each farmer for evaluation. This will require that a system of seed multiplication is in place. Seed multiplication during the dry season is currently being evaluated.

Conclusion

Based on this year's results, we identified how our two broad objectives of the variety improvement program can be achieved. First, the evaluation process could be accelerated by taking into account farmer preferences early in the evaluation process (either by using passport data or in screening the OBN-1). Second, a system for on-farm evaluation has been identified, which produced encouraging results in this first year.